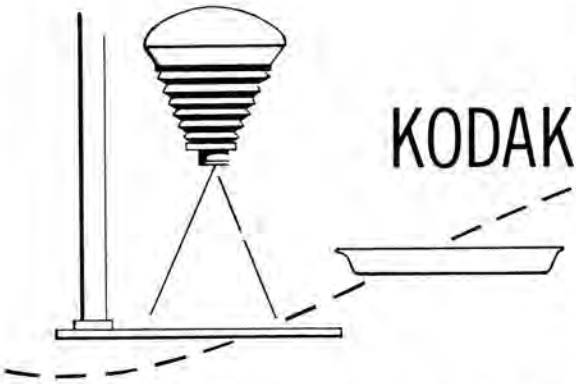
KODAK
DATA BOOK

6th Edition

50¢

KODAK PAPERS



SIXTH EDITION

KODAK PAPERS

FIRST 1958 PRINTING

This Data Book has been revised to include such Kodak Papers as Polycontrast and Polycontrast Rapid. This revision of "Kodak Papers" provides owners of the *Kodak Reference Handbook* with a replacement unit for any edition bearing an earlier printing date than 1958.

This booklet deals mainly with the characteristics of black-and-white photographic papers. The actual techniques of print making are discussed in two separate Kodak Data Books – "Enlarging with Kodak Materials and Equipment," and "Professional Printing with Kodak Photographic Papers."

"Kodak Papers" is one of a whole series of Kodak Data Books. There is a Kodak Data Book to give you accurate information on almost any photographic subject you can imagine. These Data Books are available individually, and some are also components of the various Kodak Handbooks, such as the *Kodak Reference Handbook* or the *Kodak Color Handbook*. Each is a complete unit in itself.

The Kodak Handbooks

There are six main reference books on Kodak products, processes, and techniques. Each consists of an attractive, metal-ring, stiff-covered binder containing the basic Data Books relating to one particular field, tabbed separators for indexing, space for additional Data Books and free Kodak literature, and a registration card. Filling out and returning the registration card entitles you to receive an illustrated newsletter, published several times a year, to keep you informed on Kodak techniques, materials, and processes or new and revised publications as they become available. You can keep your handbook up to date by replacing sections superseded by new editions of Kodak Data Books. These are available from your Kodak dealer.

Handbooks now published by Kodak are: the *Kodak Reference Handbook Volume 1 and Volume 2*, the *Kodak Color Handbook*, the *Kodak Professional Handbook*, the *Kodak Industrial Handbook*, and the *Kodak Graphic Arts Handbook*. The matching *Kodak Photographic Notebook* is useful for organizing additional Data Books and material on related photographic subjects.

KODAK PAPERS

SIXTH EDITION, 1955
First 1958 Printing

KODAK PAPERS

• The aim of most photographic effort is to make a print of satisfactory quality. A few photographers are content if that quality is personally pleasing; however, far more try to achieve printing quality which conforms to established standards of photographic excellence. To do this, a photographer must skillfully control many variables, but there are only three essentials: the making of a negative having characteristics which are suited to the final print, the skill to interpret the subject through the printing process, and a photographic paper whose qualities not only do not detract from the desired result but even contribute to it. Of these three essentials, it is the characteristics of the photographic paper with which this book deals primarily.

The differences between negatives and in the personal tastes of photographers, as well as the constantly increasing number of applications to which photographic prints are being put, have made a wide variety of Kodak papers necessary. It is the purpose of this book to help the photographer select Kodak papers with attributes which are appropriate to the prints he wants to make and suited to the negatives he has to work with. The characteristics of some individual Kodak papers are described in detail in the Data Sheets in the latter portion of the book. The actual techniques of printing, as well as such related subjects as toning, ferrotyping, finishing, mounting, and various print-control methods, are covered extensively in the following Kodak publications sold by Kodak dealers:

Contact Printing

Developing, Printing, and Enlarging with Kodak Materials
(elementary level, 24 pages)
Professional Printing with Kodak Photographic Papers
(advanced level, 64 pages)

Enlarging

Developing, Printing, and Enlarging with Kodak Materials
(elementary level, 24 pages)
Enlarging with Kodak Materials and Equipment
(intermediate level, 64 pages)
Bigger and Better, The Book of Enlarging
(intermediate to advanced level, 256 pages)

Manufacture

THE PAPER BASE

• Kodak Papers have their beginning in the manufacture of a paper base and, consequently, we begin this Data Book with a discussion of the manufacture of this base. Because this description is necessarily brief, it unfortunately cannot illustrate the infinite care and rigorous quality control needed to turn out a superior product. The paper base is of extreme importance to the practical photographer because its characteristics affect the photographic characteristics of the printing material. The base should have inherent permanence but no adverse effect on emulsions, for example. At the same time, the base must withstand prolonged wetting and considerable handling.

For a long while, increasing brittleness and yellowing with age were serious manufacturing problems even with the best papers. And with the Kodak discovery that these factors are also related to the keeping quality of a paper's unexposed emulsion coating, their elimination became of primary importance to the photographic paper maker.

The company's scientists at Kodak Park worked for ten years on this problem. They succeeded finally in procuring wood pulp which had a purity with respect to cellulose contents equal to that of cotton. From this wood pulp, and with improvements in the techniques of sizing, they were able to produce a paper of remarkable stability and

Paper base begins as pure cellulose sheets.

Slitting and rewinding before leaving mill.

permanence, coupled with inertness to photographic emulsions.

The actual manufacture of photographic paper starts with the high-grade pulp going down a chute to be broken up with water in a tile-lined hydrapulper on the floor below. The operator at this point selects the blend of pulps specified for the paper grade for which the batch is intended, and then meters the exact amount of water to dilute the pulp. Next, he pumps the thoroughly defibered stock into the tile-lined mixing chests where various sizing materials and dyes are added. These materials impart moisture resistance, wet strength, and tint to the final paper. All of the pipes and containers used in the manufacture of the paper base are made of stainless steel or are lined with tile to prevent contamination.

From the mixing chest, the pulp is routed into the machine chest where it is held pending its use on the paper-making machine.

From the machine chest, the pulp is next routed through a Jordan refiner which contains a rapidly turning knife-studded plug which further cuts and refines the fibers. The operator at this point can adjust the cutting action to produce desired paper-making qualities in the paper stock. The pulp is now ready for its journey down the paper-making machine.

On the continuously moving wire of the paper-making machine, the important process of water removal begins. Water drainage is assisted by suction boxes and pressure rolls until a wet paper sheet is obtained at the end of the wire. At this point, the weight of the paper is approximately one-half water.

This sheet then traverses the first of several drier sections where drier felts press the fragile sheet against a series of steam-heated drums. These drying drums, like the other handling equipment, are chromium-plated and highly polished to prevent contamination of the damp sheet.

The paper-machine operator, known as the "back tender," is responsible for the operation of the machine from the drying sections to the finishing end of the machine. There is so much shrinkage in the sheet as it travels along that it would tear apart if the operator did not control the speed of each section to compensate for it. As a result, each section is driven at a slightly different speed than its neighbor. After the drying operation, the paper's journey ends at the calender and reel section of the paper-making machine. Here, heavily weighted steel rollers compress and smooth the paper to uniform thickness. Known as "calendering," this further prepares the surface of the sheet for later coatings.

Before leaving the paper mills, all of the photographic paper is rewound, trimmed to proper width, and carefully inspected for removal of any defects. Winder men enforce quality standards that assure delivery of a uniformly high-grade product for subsequent operations. Each roll is held in storage until detailed physical, chemical, and photographic tests have been made. After approval, following these tests, the raw paper base is ready for the next manufacturing operation – either baryta coating or direct sensitizing with the light-sensitive emulsion.

In the Baryta Division, a baryta mixture, consisting of a suspension of barium sulfate in gelatin is applied to the paper. The barium sulfate is manufactured by reacting barium and sulfate ions. The resulting slurry is washed (to eliminate excess salts of the reaction) and concentrated by centrifuging to a uniform solids content. This barium sulfate is then mixed with gelatin, dyes, and other materials to produce the coating mix. Coating machines spread the baryta mixture onto the raw paper, and automatic controls keep the amount of coating even as the paper moves through the machine. These controls are necessary because almost a mile of paper can be coated before it is inspected at the winder after drying by heated air.

When the baryta is dry, the resultant coating fills in the pores of the paper fibers to provide a foundation for and increase in the brilliance of the subsequent light-sensitive emulsion coat. The paper surface is then smoothed out further by passage between massive steel calender rolls. Depending upon the amount of pressure applied, the calendering operation imparts a dull or glossy surface. Rough-textured papers are calendered lightly, if at all, while glossy papers are calendered under extreme pressure. Some surfaces, notably silk, are formed by passing the baryta-coated paper under an embossing roller which operates under high pressure. Finished baryta-coated paper is kept in special storage racks awaiting the results of tests and approval to apply the light-sensitive emulsion in the next operation.

Baryta-coated paper is calendered to control surface sheen. Rough-textured papers are calendered lightly but glossy papers with extreme pressure.

THE EMULSION

Up to this point the product has been made and handled in white light. However, from the moment the light-sensitive emulsion is applied, the product has to be handled and stored in complete darkness or under suitable safelights.

The vehicle for the photographic emulsion is a grade of gelatin considerably purer than that normally required for human consumption. The other chemicals involved in emulsion making have comparable high-purity requirements.

The emulsion-making process is initiated by dissolving certain chemicals, called "halides," in a gelatin solution. When this is done, a solution of silver nitrate is added according to a prescribed schedule of temperature, agitation, and rate. The silver nitrate solution for this operation is made from a supply of pure silver. Kodak maintains a supply second in value only to that of the United States mint.

With the addition of the silver nitrate solution, silver halides, or light-sensitive compounds, are formed in the gelatin. The by-products of this reaction may be left in the mixture or may be washed out, depending on the type of emulsion being made. The emulsion characteristics are further determined by subsequent operations, such as cooking, digesting, chilling, melting, etc. Still further variety is made possible by the addition of certain chemicals which impart special properties. Among these chemicals are sensitizing dyes which determine the speed and spectral sensitivity, matting agents which determine the sheen, spreading agents which improve the physical coating quality, and hardeners which give the thin emulsion layer enough physical strength to withstand the rigors of handling, processing, and drying.

The application of the emulsion to the base is performed by modern, specially designed machines employing automatic devices for uniform-thickness control. Immediately after emulsion coating, most papers are overcoated with a layer of clear gelatin which protects the emulsion against abrasion. Great care has to be taken to insure that the air used in the drying operation is free of all contamination, such as dust, smoke, pollen, etc. This precaution has become even more important in this atomic age when radioactive particles are frequently in the air. As a result, a continuous around-the-clock check for radioactivity in the air supply is made.

The finished sensitized paper is now in the form of rolls slightly over 40 inches wide and thousands of feet in length. Samples are taken from each roll for detailed chemical, physical and photographic tests.

Shiny silver ingots used in making photographic emulsions are stored in a Kodak Park vault. More than twelve tons of silver are used every week. Each ingot weighs 75 pounds and is 99.97 percent pure.

CUTTING AND PACKING

The next step is to convert each of these large sensitized rolls into the many sizes of paper required in the photographic trade. Basically, these requirements fall into two categories, sheet paper and roll paper.

The various sheet sizes are obtained by cutting large sheets from the big "master" roll of sensitized paper. These large sheets are stacked in standard units and cut to smaller sizes in powerful guillotine-type cutting machines.

The various roll sizes are obtained by slitting the "master" rolls to the desired widths and spooling the required length on an appropriate core.

During these operations, highly trained inspectors are constantly on the alert for flaws in the product which are removed as they are detected. Illumination is adjusted to give maximum tolerable light for inspection and yet not fog the product.

Other special operations are involved in the preparation of deckle-edged paper, album-sheet paper, and perforated paper.

The inspected paper is then packaged, labeled, and shipped.

Characteristics of Kodak Papers

• In general, most photographic papers consist of light-sensitive emulsions coated on paper stock. Here their resemblance ends because photographic papers differ in a great many respects, depending on their photographic and physical properties. Without a knowledge of these differences and the reasons for them, the photographer will not be able to choose his papers intelligently and use them to the best advantage.

The photographic properties which are most important to the photographer are (1) the printing grade of the paper and (2) the speed of the emulsion. These two properties are discussed in the section dealing with photographic characteristics.

The physical properties of most importance are (1) the tint of the paper, (2) the texture of the paper surface, (3) the gloss of the paper surface, and (4) the color of the photographic image. These properties determine the suitability of a paper to the subject matter and intended use of the print. They are discussed under the section dealing with physical characteristics.

PHOTOGRAPHIC CHARACTERISTICS

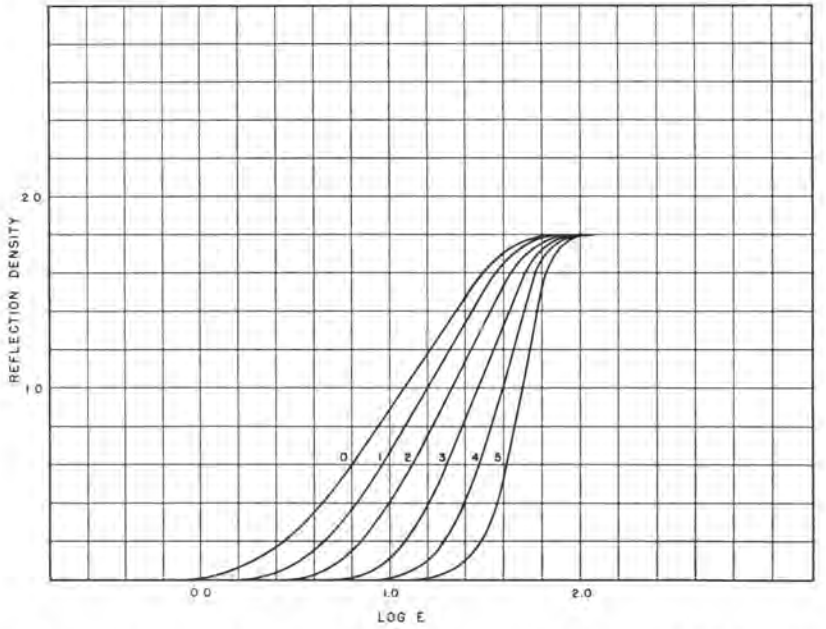
The photographic emulsion, generally speaking, is composed of light-sensitive silver salts suspended in gelatin. The chemical composition of the silver salts, the method of their formation, and the addition of special agents determine such photographic qualities as speed (sensitivity to light), printing grade, and image tone. The silver salts most commonly used are silver chloride and silver bromide. Silver chloride is inherently less sensitive to light than is silver bromide. It therefore predominates in the slower papers. It also yields an image composed of smaller particles; as a result, papers having a predominantly silver chloride emulsion usually can be toned to a greater extent than those classified as a silver bromide emulsion.

Speed, however, does not depend primarily on the type of halide used. Many manufacturing controls are used in adjusting emulsion speed. One of the more recently introduced controls is the use of dyes which confer sensitivity to various parts of the spectrum. Such dyes are used, for example, to obtain a desirable speed relationship among the grades of several papers.

SENSITOMETRIC CURVES

The response of a photographic paper to increasing amounts of exposure to light can be represented by a characteristic curve obtained by plotting the reflection density of the developed image against the logarithm of the exposure. The reflection density is the logarithm of the reciprocal of the reflectance of the image, and is usually measured by means of a reflection densitometer. Logarithmic values are used because the human eye tends to respond logarithmically rather than arithmetically to various intensities of light. The curve thus obtained for a photographic paper is often called a "D-log E curve" or a "sensitometric curve."

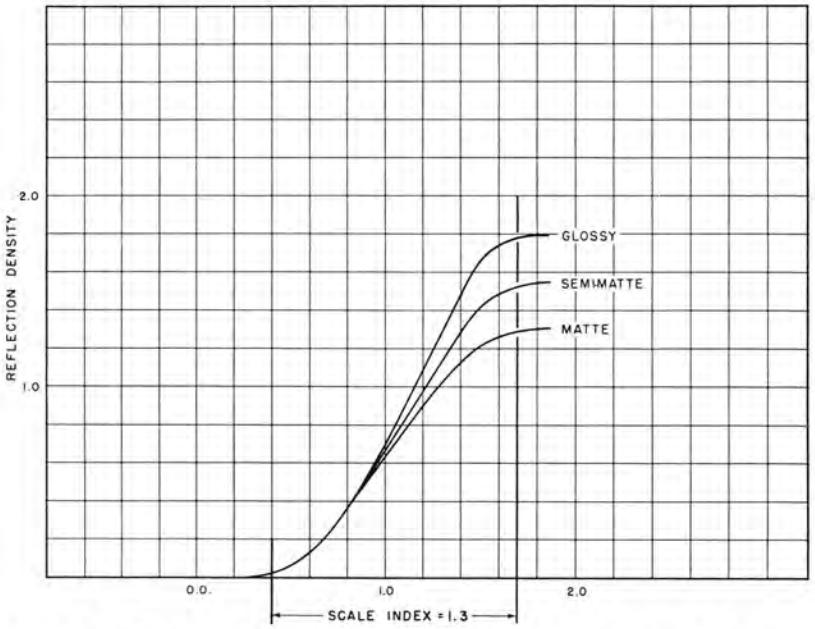
In the accompanying illustration are shown typical D-log E curves for the six different grades of a family of Kodak papers, all having a glossy surface. The maximum density tends to be the same for the different grades if the surface is the same, but the rate at which density increases with exposure is seen to be least for the grade 0 paper and greatest for the grade 5 paper.



Sensitometric curves which represent approximately the characteristics of Kodak papers having a glossy surface.

Papers having semimatte or matte surfaces usually give sensitometric curves which are similar to those shown for the glossy papers, except that the maximum densities of the semimatte and matte papers are lower. If the curves for a grade 2 glossy paper, a grade 2 semimatte paper, and a grade 2 matte paper, all of the same emulsion type, are compared, they usually will be found to be similar to those shown in the next illustration.

Typical sensitometric curves for grade 2 Kodak papers with a glossy, semimatte, and matte surface, respectively.



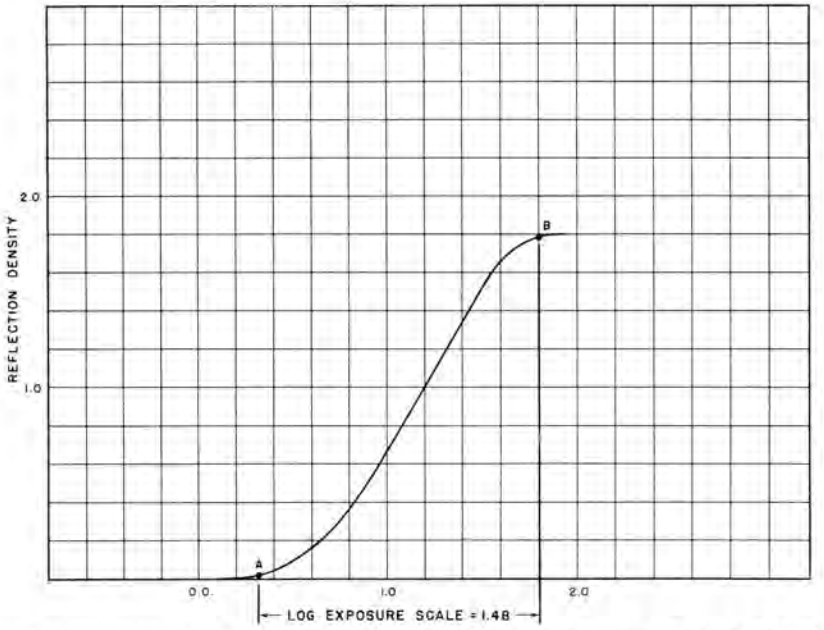
A scene such as this fog-bound ship, with a limited tonal range, can well be printed on a matte-surfaced paper.

A scene with heavy shadows and brilliant highlights, such as this shot of Grand Central terminal, is best printed on a glossy paper.

EXPOSURE SCALE AND SCALE INDEX

The exposure scale of a paper is an expression of the range of light intensities required to produce a print having a full range of tones from white to black. Thus, a paper having an exposure scale of 20 would just accommodate a negative which transmits a range of light intensities of 20 to 1. Logarithmic units are generally preferred for expressing exposure scale, since the resulting number can then be compared more readily with the density difference (density scale) between the maximum and minimum densities of the negative. The exposure scale of 20 corresponds to a log exposure scale of 1.3.

A method of determining log exposure scale values from the sensitometric curves of the papers is defined in the American Standard for Sensitometry and Grading of Photographic Papers.* The accompanying diagram shows the log exposure scale interval indicated on the D-log E curve of the paper. It is the interval lying between two points, *a* and *b*, which are specified in the standard. The log exposure scale is 1.48 for this particular paper.



The derivation of the log exposure scale from the sensitometric curve. The scale index is obtained by rounding off the value of 1.48 to 1.5.

*American Standard for Sensitometry and Grading of Photographic Papers, PH2.2-1953, American Standards Assoc., Inc., 70 E. 45th St., New York 17, N. Y.

Since the term "log exposure scale" is inconveniently long for general use, the American Standard recommends that the name "scale index" be applied to values of log exposure scale that have been rounded off sufficiently for easy application in practice. The values are rounded off to the nearest figure after the decimal point. Thus, the log exposure scale of 1.48, derived from the D-log E curve shown in the diagram, would be rounded off to a scale index of 1.5.

As will be described more fully, the scale index is useful in the practical problem of fitting the paper to the negative and also in the more general problem of specifying paper characteristics.

GRADE NUMBER AND SCALE INDEX

The grade numbers, 0, 1, 2, 3, 4, and 5, have for many years been used as an approximate indication of the type of negative which can be printed successfully on each grade of paper. Thus, a negative having a long density scale usually prints best on a grade 0 paper, while a negative having a short density scale usually prints best on grade 5 paper. The reason for this is that the grade 0 paper usually has a long scale index, while a grade 5 paper usually has a short scale index. For most papers there exists, on the average, a fairly definite relation between grade number and scale index. A specific relation is not required by the American Standard PH2.2-1953, but one of the purposes of the standard is to encourage the grading of papers in relation to their scale indexes. The standard recommends that the scale indexes be adopted as the basis of grading and that scale index values for the various grades be published in descriptive literature by the paper manufacturer. A given paper may, for example, then be described as "grade 2, scale index 1.3."

The following table shows the approximate relation between grade number and scale index for Kodak papers:

Paper Grade Number	Approximate Scale Index
0	1.7
1	1.5
2	1.3
3	1.1
4	0.9
5	0.7

Individual papers will not always follow the above relation precisely, but the approximation is close enough for most purposes.

RELATION OF NEGATIVE TO PRINTING PAPER

Because of the variations in the type of subject matter in original scenes, there is no exact relation between the density scale of the negative and the scale index of the paper required for a good print. Statistically, however, there is a best relation which will give the highest yield of prints of good quality. By printing a large number of negatives on the different grades of paper and having many observers choose the best grade for each negative by selecting the most pleasing prints, research workers have found that the scale index should, on the average, be about 0.2 greater than the density scale of the negative. The reason for this appears to be that the method of measuring scale index takes into account the total available scale of the paper, while in practice it is desirable to use less of the extreme shoulder portion of the paper curve. The following table shows the recommended relation between the density scale of the negative and the scale index or grade number of the paper.

Paper Grade Number	Scale Index	Density Scale of Negative Usually Suitable for Each Scale Index or Grade
0	1.7	1.40 or higher
1	1.5	1.2 to 1.4
2	1.3	1.0 to 1.2
3	1.1	0.8 to 1.0
4	0.9	0.6 to 0.8
5	0.7	0.6 or lower

The density scale of the negative used in the above discussion is its *effective* density scale *at the exposure plane* of the paper, regardless of whether it is projected or not. A given negative will usually have a greater effective density scale in a specular-type enlarger than it will in a diffuse enlarger or contact printer. The density-scale value obtained by measuring the negative in a diffuse transmission densitometer will generally agree approximately with the effective density scale of the negative used in a contact printer. In a diffuse enlarger, flare light will lower the effective density scale by 10 percent or more. In a condenser-type enlarger using a photoenlarger-type lamp which has an opalized bulb, the effective density scale may be 15 to 25 percent higher than that measured by a diffuse densitometer. In a condenser-type enlarger using a lamp with a clear bulb and a relatively small filament, the effective density scale may be as much as 60 percent higher than the value measured in the densitometer.

PAPER SPEED

Speed numbers are of interest to the photographer as an approximate indication of the relative exposures required for the various papers. The greater the speed, the less the exposure. For example, it may be desirable to make a print on Kodak Opal Paper after the exposure has been determined for a grade 2 Kodabromide Paper for the same or a similar negative. The speed of the former is about one-fifth that of the latter, and, consequently, the exposure required for the Opal Paper will be about five times the exposure required for the Kodabromide Paper.

Shadow Speed. The shadow speeds given in the data section are based on the amount of exposure required to produce the maximum useful density. The formula for the speed is: Speed = 10,000/Es, where Es is the required exposure in meter-candle-seconds. The resulting values are called "shadow speeds" because most negatives should be printed so that the extreme shadow region of the negative is reproduced at a high reflection density near the point where the speed is measured.

Shadow speeds can be helpful in determining the exposures for different negatives when each is printed on the most suitable paper grade. In this case, the printing time is determined by two factors — the shadow speed of the paper and the minimum density of the negative. Approximate shadow speeds for all grades of Kodak Papers are given in the data section beginning on page 52. The technique for measuring negative densities is discussed on page 33.

Printing Index. When the same negative is printed on two different grades of paper, the shadows usually should not be printed to the same density on the two papers. The best result is obtained, on the average, if some middle-tone density in the negative is printed so that it is reproduced at a fixed middle-tone reflection density on the two papers. The ratio of the two exposures will be the ratio of the printing indexes of the two papers. Tests show that this type of speed can be measured in terms of the exposure required to obtain a reflection density of 0.6. The formula is: Speed = 10,000/Em, where Em is the required exposure in meter-candle-seconds.

Printing indexes are helpful in finding the new correct exposure time when printing the same negative on a different paper or on a different grade of the same paper. The Enlarging Computer in the *Kodak Master Darkroom Dataguide* also helps determine proper exposure when changing magnification.

For example, suppose that a print had just been made on Kodabromide grade 3 using a 20-second exposure. However, room light examination shows the print to be excessively contrasty and it is evident that an improved print could be made on grade 2 Kodabromide. The question is, of course, what is the new exposure time? This is easily determined from the printing indexes for the two grades, which are given in the data sheet, page 56. Since the exposure times are inversely proportional to the printing indexes, the exposure for grade 2 would be equal to the exposure found for grade 3 multiplied by the ratio between the printing indexes of 3 and 2

$$\left\{20 \text{ seconds} \times \frac{2000}{3200}\right\}, \text{ or approximately 12 seconds.}$$

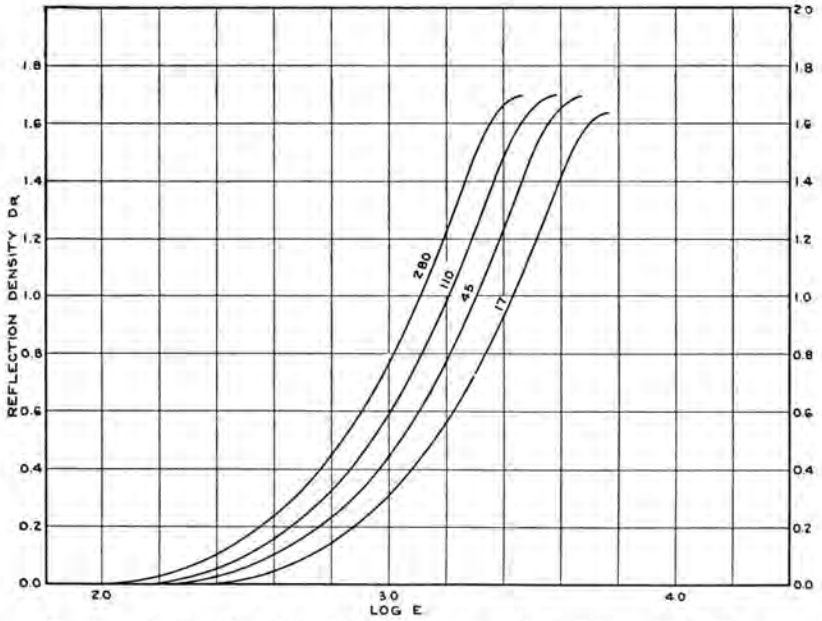
As a second example, suppose that a correctly made print on grade 2 Kodabromide required a 10-second exposure. But this time it was desirable to make another print on Kodak Opal Paper – what is the new exposure? The printing index of Opal is 650; that of grade 2 Kodabromide is 3200. The new exposure time is found by multiplying the previous exposure time of 10 seconds by $\frac{3200}{650}$, or 5 (the ratio of the indexes between the papers involved) for an answer of 50 seconds.

Approximate printing index values for all grades of Kodak papers are given in the data section beginning on page 52.

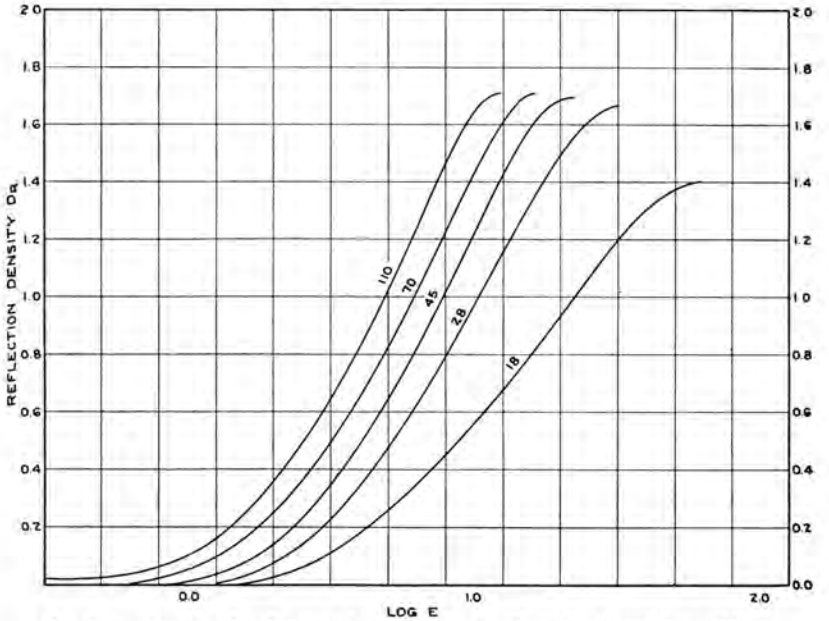
Factors Affecting Speed. In making the test exposures to determine speed values, a fixed exposure time of 5 to 10 seconds is generally used and the intensity of the exposing light is varied. Intensity and time are only approximately interchangeable in producing a given photographic effect. A 100-second exposure with 1 meter candle of illumination usually gives a noticeably lower density than a 1-second exposure with 100 meter candles of illumination. This lack of perfect interchangeability of time and intensity is known as "failure of the reciprocity law." It is obvious that the effective speed of a paper will depend somewhat on the time of exposure used in a particular application. The effective speed also depends on the spectral quality of the light source. The published speeds were obtained by using tungsten lamps at a color temperature of about 3000 K. For fluorescent lamps, these speeds will apply only as an approximate guide. Development conditions, age of the paper, and the storage conditions also influence speed. Since speed is affected by a great many factors, the published speeds cannot be regarded as absolute values. For individual problems, the effective values should be found by trial.

DEVELOPMENT LATITUDE

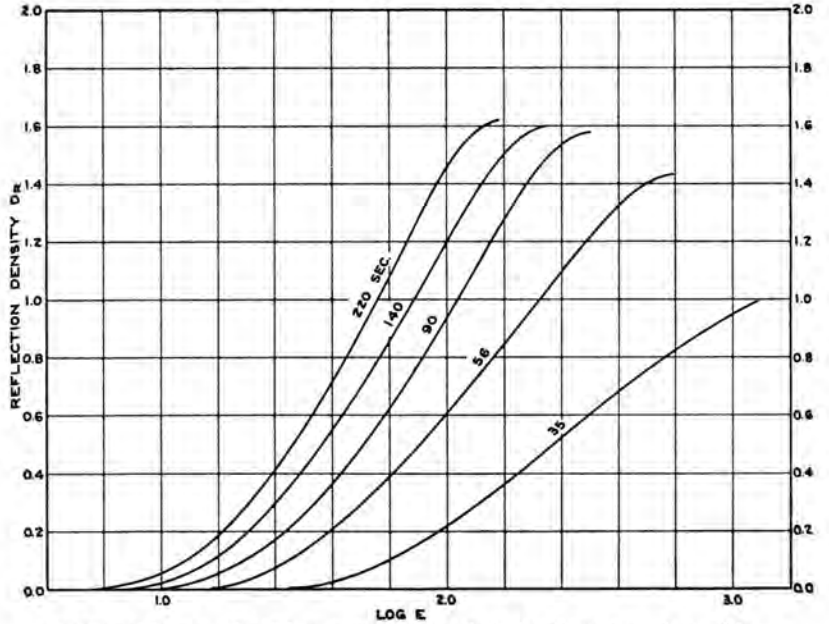
Development latitude is the interval between the greatest and the least printing exposure times which produce satisfactory results, the development time being varied for compensation. The best possible prints are obtained by exposing so that development takes place within the recommended range of developing times. Acceptable prints, however, may be obtained throughout a reasonable exposure range. Throughout the wide development latitude of Kodabromide and Kodak Velox Papers, for which both are noted, there is practically no change in image color. Warm-tone papers, such as Kodak Opal, grow progressively colder with increased development. It should be mentioned, however, that prints made on Kodak Velox and Kodabromide Papers, in addition to showing practically no change in image color with variations in development time, show little or no change in contrast. Prints on warm-tone papers, such as Opal, appear lower in contrast with overexposure and underdevelopment and higher in contrast with underexposure and overdevelopment.



Sensitometric curves for different development times for chloride emulsions of the Kodak Azo type



Sensitometric curves for different development times for chloro-bromide emulsions of the Kodabromide type



Sensitometric curves for different development times for chloro-bromide emulsions of the Kodak Opal type

COLOR SENSITIVITY

Photographic papers for general use have color sensitivity which lies in the ultraviolet, violet, blue, and blue-green portions of the spectrum. Their sensitivity, however, does not cut off abruptly at any given wavelength; it decreases gradually as the wavelength of the exposing light is increased. For this reason, safelight design involves some compromise between adequate visibility and freedom from fogging. If the safelight recommendations in the Data Sheets are followed, particularly with regard to the wattage of lamps and the distance from the working surface at which they are used, fogging of paper by safelight exposure can be avoided.

The more flagrant cases of poor safelighting are easily detected since the masked border of the paper will show evidence of fogging. However, it is possible for poor safelighting to degrade the quality of the print image without actually fogging the clear border. This is due to the cumulative effect of the safelight exposure plus the printing exposure. The safelight exposure alone may not be enough to cause fogging, but when added to the normal printing exposure, the safelight exposure becomes developable and usually results in veiled highlights and lack of "snap" in the picture.

A test to determine safelight suitability is given on page 42.

1. This area received 2 minutes of safelight exposure, plus negative exposure.
2. This area received 1 minute of safelight exposure, plus negative exposure.
3. This area received 30 seconds of safelight exposure, plus negative exposure.
4. This area received the negative exposure only.

(1) (2) (3) (4)

CONTRAST OF PRINTS

The contrast of a print, that is, its visual appearance, is the observer's impression of brightness differences. It depends on the character of the scene; on the type of film, its exposure, and processing; and on the kind of printing paper. This *subjective* contrast should not, incidentally, be confused with *objective* contrast which refers to the measurable brightness ratio of any two areas. For example, the objective contrast of two adjacent steps on a gray scale could be measured with an exposure meter or a photographic densitometer. However, this Data Book is concerned only with subjective contrast, such as the contrast of a print from a given negative, which depends, of course, on the printing paper and its handling.

The contrast of a print is a rather complex characteristic to describe. For example, consider these aspects of contrast: a print made on a G-surface paper is more contrasty when it is wet than when it is dry; a print from a given negative is less contrasty when printed on Kodabromide Paper F-2 than when it is printed on Kodabromide Paper F-3; and a glossy print on No. 2 printing grade is more contrasty than a matte-surface print also on No. 2 printing grade. These are correct uses of the word "contrast," yet they may be somewhat confusing examples unless the "two-dimensional" aspect of contrast is clear.

Like color, which must be described in terms of hue, brightness, and saturation, contrast is also a word which has a compound meaning. The two independent attributes which determine contrast are *gradient* and *range* (or *extent*). Technically speaking, the gradient is the rate at which the density* increases with exposure. The range (or extent) is the total density range available in the print from light to dark.

These two components of contrast might best be explained by the following analogy: Consider for a moment a person climbing a hill. In this example, the visual impression of contrast is being compared with the *effort* required to climb the hill. This effort is proportional to both the height (range) of the hill and its slope (gradient). Thus it follows that more effort will be required to climb hills either steeper or higher, or both. The same is true of contrast which can be increased by using a paper with a steeper gradient, a higher maximum density, or both.

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*Reflection density is the log of the reciprocal of the reflectance of an area, where illumination is at 45° to the surface, and the sample is viewed at 90°.

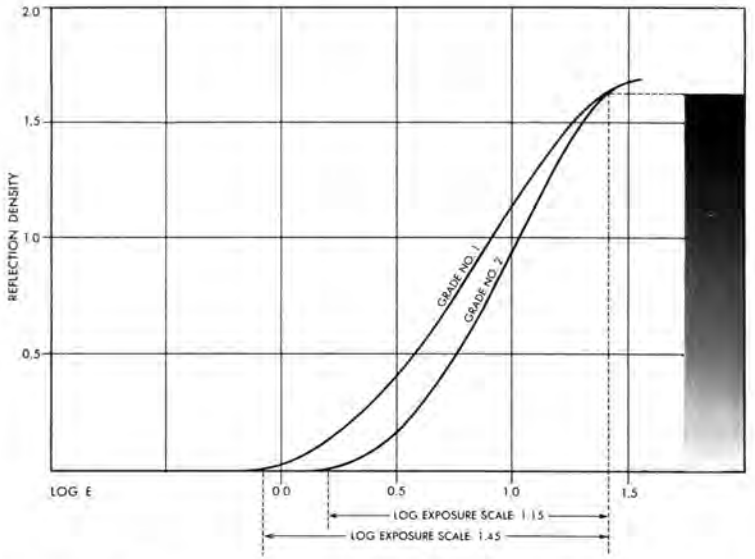
CONTRAST OF PAPERS

Since contrast is concerned with subjective impressions, an unexposed sheet of photographic paper does not have contrast. However, it does possess a certain *contrast capacity* which is related to gradient and density range. Actually, it is the combined effect of both factors, or technically speaking, the product of these two factors. It should be kept in mind, also, that prints do not always utilize the full contrast capacity of the paper. Let's take a closer look at some of the factors which influence these characteristics:

Gradient. For prints made on No. 1 and No. 2 printing grades of the same paper, the available maximum density is the same. If the same negative is used for each, the print on the No. 2 printing grade appears more contrasty. In fact, it is too contrasty if the negative is best suited to the No. 1 printing grade. The reason is that the rate at which density increases with exposure is more rapid for No. 2 printing grade than for No. 1 printing grade. Therefore, No. 2 printing grade reaches its maximum density sooner, speaking exposurewise.

The total interval in exposure is shorter for No. 2 printing grade, that is, its exposure scale is shorter. In the case we have chosen, it is too short to accommodate all the tones represented in the negative. The factor in a paper that makes it fit a negative in a manner described later is this exposure scale of the negative. Printing grades range, then, in exposure scale from a long scale with grade 0 to a very short scale with grade 5. No. 2 and 3 have exposure scales that are in the normal range, that is, they fit most good negatives.

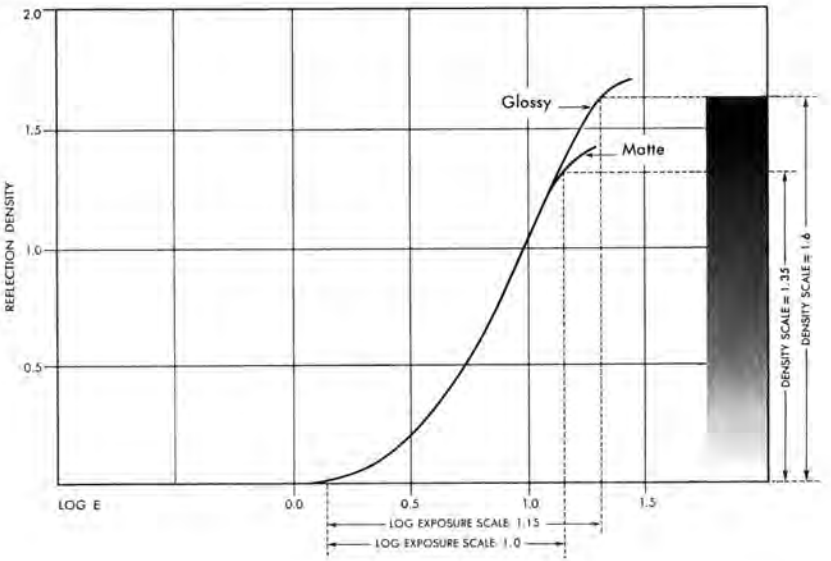
It is physically impossible to retain all of the tones of the original scene for most subjects. Best paper selection for effect of reality is one with highest possible sheen.



The curves in these two graphs were selected to show, as nearly isolated as possible, the principal factors affecting contrast: gradient, and density scale.

Above: although the *maximum density* of the two papers is the same, the contrast capacity of No. 2 is greater because its average gradient is steeper.

Below: although the *gradient* of the two papers is the same, the contrast capacity of the glossy paper is greater because its maximum density is greater.



NEGATIVES FOR BEST PRINT QUALITY

The best prints are, of course, made from good negatives. A good print cannot be made from a negative which either lacks detail in the shadows or has dense, flat detail in the highlights. The question therefore arises – what is a good negative?

Actually, a "good negative" is not fixed in its properties. It does simplify the making of good prints, however, if most negatives can be made to print uniformly on a single grade of paper, preferably No. 2, with little variation in printing time. A single box of Kodak Polycontrast or Polycontrast Rapid Paper provides seven different grades of contrast. The following discussion concerns the properties of negatives which fit a No. 2 paper grade.

It is not practical to make all negatives to print on a single paper, but it should be of help to specify their measurable properties. A negative which prints best on paper of No. 2 grade has a density scale within the range of 1.0 to 1.20. This density scale also suits single contrast grade papers such as Kodak Opal Paper, a further reason for aiming at such quality. The lowest shadow density should fall between 0.2 and 0.3. The average lowest shadow density that results from proper exposure-meter use is about 0.2. The highest density should be 1.25 to 1.50, depending on the method of exposure determination. These highlight density values do not include areas in which

No. 1 FILTER
8 Seconds, f/8

NO FILTER
5 Seconds, f/8

No. 4 FILTER
30 Seconds, f/8

A normal negative was used to make three prints, each of a different contrast, to illustrate the range of contrasts possible when using Kodak Polycontrast Paper with the Kodak Polycontrast Filter Kit. The print at the left was exposed through the No. 1 Filter, giving the equivalent of a grade 1 paper. No filter was used for the center picture to produce a normal print, the equivalent of a grade 2 paper. The print on the right was exposed through a No. 4 Filter to produce a contrasty effect, such as you would get with a grade 4 paper.

no detail will print, such as the sun's reflection on water, and other easily recognizable glossy reflections. They also exclude any overcast sky, or any sky in a negative of a subject in shade. A desirable density scale usually results from a medium range of subject brightnesses and normal negative development.

The usual outdoor scene has a brightness range far exceeding that reproducible on paper, but it is well known that good prints can be made of such subjects. When supplementary lighting is added to the subject to reduce its brightness range appropriately, and the development is appropriate, prints of beautiful quality can be made. Therefore, the making of the best possible print starts in front of the camera.

It is, of course, impractical to adjust the brightness range of all subjects. It is necessary to shoot many subjects "as is." The various brightness ranges encountered and the effect of scene structure on lens flare are some of the reasons for needing different paper grades.

Adjusting Negative Development. The degree of development can be selected so that the majority of the negatives can be printed on No. 2 paper. Density measurements can be made on selected negatives with a densitometer until experience is gained in judging them. Another approach is this: If negatives tend to print mostly on No. 1 paper, then decrease the development time of the negatives to give a decrease of 0.15 in gamma. Shortening the development time by about a quarter of the total time will do this. On the other hand, if average negatives print on No. 3 paper, increase the gamma of the negatives by 0.15, or increase development by about a third of the time previously used. Like other published photographic data, recommended development times should be regarded by the careful worker as a basis for trial and, if necessary, as a point of departure. Incidentally, the Kodak Developing Dataguide is helpful in determining the correct developing times for various combinations of Kodak films and developers. It is not practical to adjust the development to obtain a precisely predictable density range.

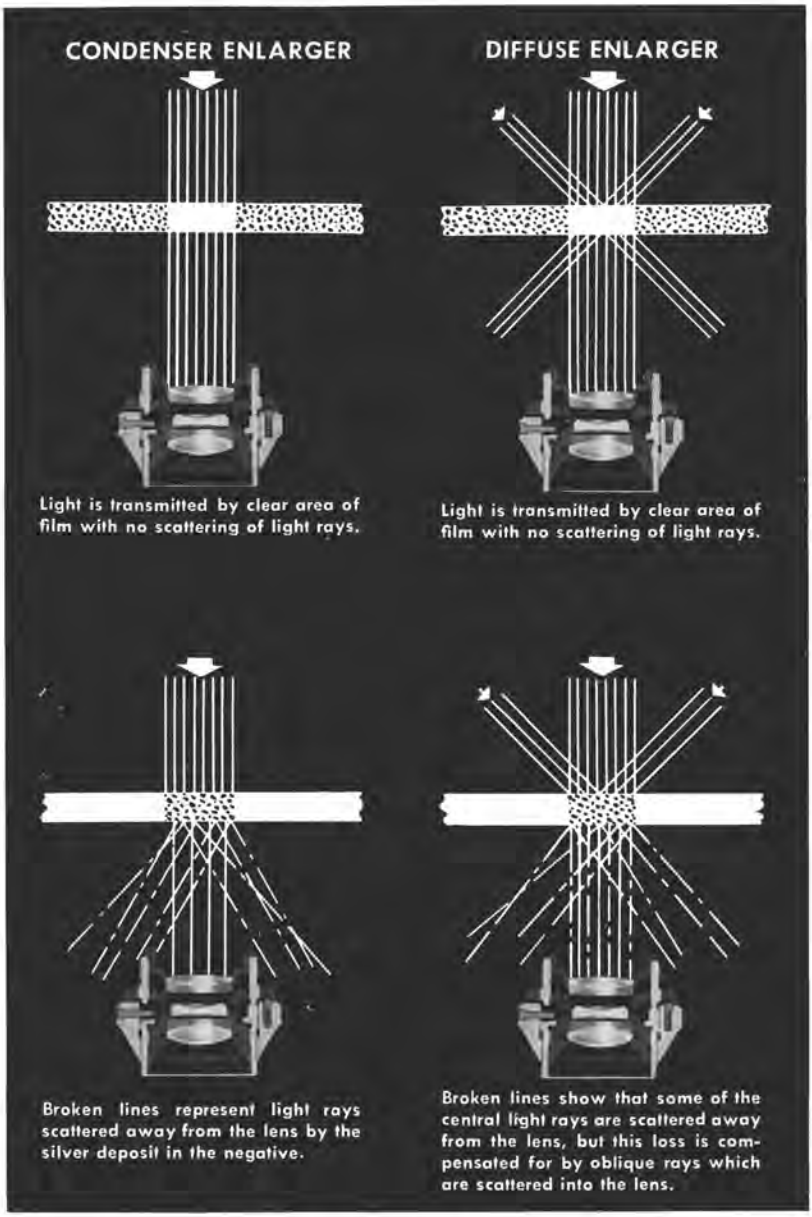
Negatives which are underexposed call for the so-called "salvage grades" of paper, that is, grades 4 and 5. As mentioned before, even with an appropriate grade of paper, an excellent print is not usually possible from a poor negative. If the negative is extreme because of overdevelopment or underdevelopment, but the exposure has been appropriate to the degree of development, then good prints can be made on the extreme paper grades because all tone values are present in the negative and the gradient can be corrected by the appropriate paper grade.

OTHER FACTORS AFFECTING PRINT CONTRAST

Contrast and Enlarger Illumination. In general, the degree of contrast obtained with completely diffuse illumination of the negative in an enlarger is of the order of that obtained in contact printing. However, enlargers equipped with condensing lenses produce projected images with greater contrast than enlargers with diffuse illumination, other factors being equal. The explanation of this difference may be of interest. When the "specular" light beam in a condenser enlarger strikes an area of low or no density in the negative, practically no light is scattered; nearly all the transmitted light then enters the enlarger lens and is printed as an area of high density in the final picture. When the same light beam strikes a negative area of high density in the final picture, part of the beam is absorbed, and part is scattered so it does not reach the projection lens. Therefore, this high density does not let as much light reach the paper in projection printing as it does in contact printing, where even the scattered light is printed. The effective density of the highlights in the final projection print is decreased. Since there is little or no effective decrease in the shadow densities of the print, the contrast of the enlarged print is higher than that of a contact print.

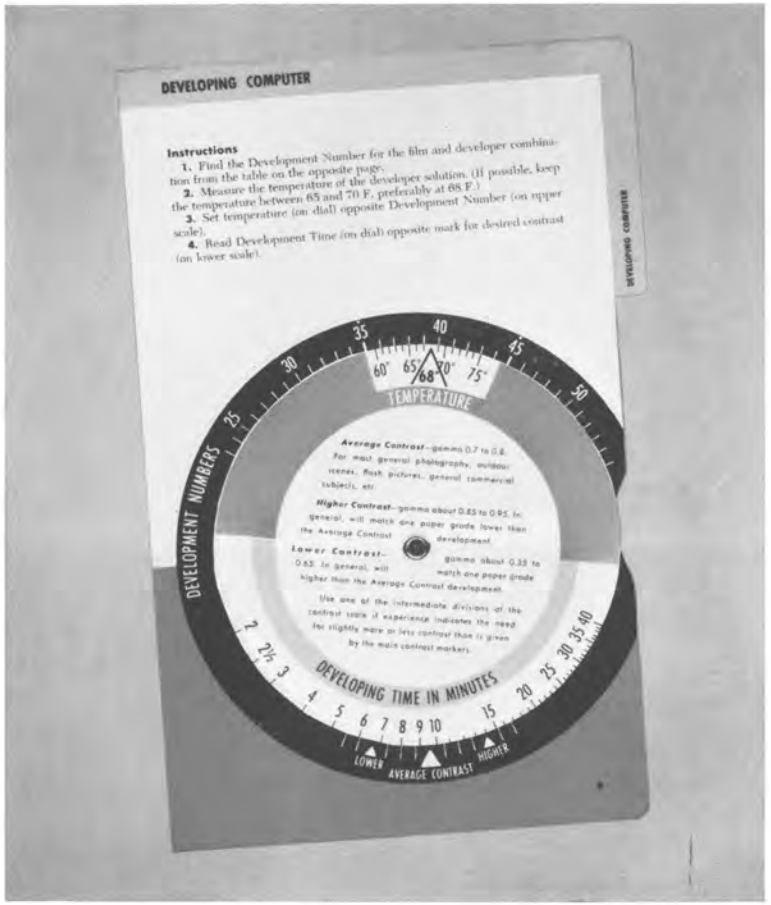
Now consider what happens to high and low negative densities in an enlarger with diffuse illumination. Oblique rays pass through a low-density area with little or no scatter and hence do not pass through the enlarger lens. When the same oblique rays strike a high-density area, light is scattered in all directions. One direction is, of course, toward the enlarger lens, so that some scattered light from all beams reaches the lens. This part of the scattered light adds to the transmitted part of the central beam. It works out that what the central beam loses by scattering it makes up by scattered light from other beams. The result is that the effective density scale is the same as it is for contact printing. Such a negative density scale is lower than its effective value in a condenser enlarger, where light lost by scatter is not replaced.

The difference between enlargers because of these effects can be as much as the difference between No. 2 and 3 grades of paper. If a condenser enlarger has little or no diffusion in it, the difference may be even greater. Prints made on a No. 3 printing grade of paper with a diffuse enlarger approximately match prints made from the same negative on a No. 2 printing grade of paper with a condenser enlarger. All fluorescent-light enlargers are diffuse in illumination. This is true for the diffusing-plate type and for the "light-integrator" type.



In a condenser enlarger, the effective density of a dense area is increased while transparent areas are unaffected. Therefore, the difference between high and low densities is effectively greater than in a diffuse-type enlarger.

It has been mentioned that a diffuse enlarger produces an effective density scale which is approximately equivalent to that present in contact printing. It may actually be slightly lower, due to flare in the projection lens. Such flare is greatly aggravated if light can pass the edges of the negative. Whereas flare in a camera lens affects shadow quality, enlarger lens flare, if present in a notable amount, degrades highlight rendering.



Ideally, your goal should be to make all negatives so that they print on the same grade of paper—preferably grade No. 2. One of the best control guides to accomplish this is the Developing Computer in the Kodak Master Darkroom Dataguide, which is an easy-to-use dial calculator for determining the correct developing times for various combinations of Kodak films and developers.

Developer and Development Time. The contrast capacity of photographic papers is, for most practical purposes, determined by inherent characteristics in the emulsion, and it can be controlled only within narrow limits by variations in development time or developer composition. Kodak Selectol-Soft Developer is a developer modified to reduce contrast slightly without loss of print quality. The effect of using this developer is to change the exposure scale to the extent of about one printing grade. Such control applies only to the papers for which Kodak Selectol Developer is recommended.

The effect of different development times on the densities and curve gradients of various papers will be of interest to many photographers and darkroom operators. In the curves (pages 16 and 17), samples of each paper tested were exposed to tungsten light at 2800 K for 4 seconds and developed for the times marked on the curves.

The extremely long development times given on the curves should not be used unless processing conditions are ideal. This assumes that the solutions are fresh and there is no danger of safelight fog. Very short development times should be avoided, since they do not permit a satisfactory maximum density to develop.

It will be noted that, over the range of development times given for each paper, the principal effect of increased development time is to give the appearance of increased exposure, or greater over-all print density, rather than increased gradient. The curves also show that chlorobromide papers, such as Kodabromide, develop quite rapidly, but that chlorobromide papers, such as Kodak Opal, build density more slowly. With papers of the latter type, short development times are particularly to be avoided. The behavior of Kodak Velox Paper is similar to that of Azo Paper. Kodak Illustrators' Special Paper resembles Opal Paper.

When studying these development-rate curves, keep in mind that the time of normal development is 60 seconds for Azo Paper, 90 seconds for Kodabromide Paper, and 120 seconds for Opal Paper. For best results, a paper of suitable grade should be chosen to fit the negative and should be exposed for proper density when developed for the recommended time.

It should not be inferred that, for example, the data for Kodabromide Paper indicate a useful range of from 28 to 110 seconds when the range actually recommended is from 60 to 180 seconds. A Kodabromide print developed for as short a time as 28 seconds will probably not be satisfactory because of underdevelopment mottle.

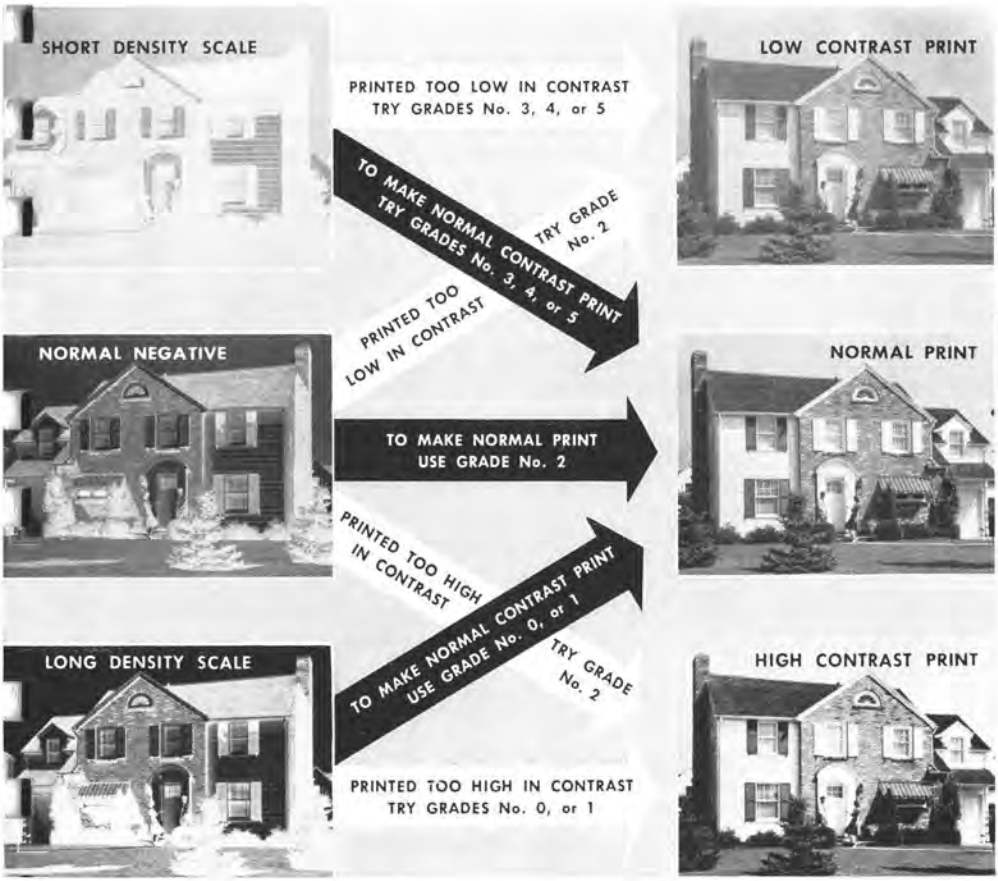
CHOICE OF PAPER GRADE

Correct choice of paper grade is essential to good print quality. It involves selecting a paper with a scale index suitable for the density scale of the negative. See the table on page 13. Uniform development of all negatives does not necessarily suit them to a single paper grade, because the brightness scale which varies from subject to subject also affects paper choice. With practice, the selection can usually be made by inspection.

Ability to judge the required paper grade from the visual appearance of a negative can be gained by systematic trial and careful observation. By printing various negatives on all grades of Kodak Azo or Kodabromide Paper, the effect of paper grade on print quality can be observed. The muddy appearance of a print with insufficient contrast or the harsh effect of a print with excessive contrast can be compared with the best print of each series. It is also helpful to file with each negative a record of the paper found to give the most satisfactory print from it. Much valuable information can be gained, too, by comparing carefully each good print with the negative from which it was made, especially with respect to the density difference between highlight and shadow areas in the negative, that is, density scale. One will then learn to select the correct grade of paper by examining the negative by suitably diffused illumination.

A print made on paper of the wrong grade may seem passable until it is compared with one made from the same negative but on paper of the correct grade.

With practice, the selection of the most suitable paper grade can usually be made by careful inspection of the negative.



As an aid in selecting the correct paper grade, decide which of the negatives in the accompanying illustration most nearly matches the density scale of the one to be printed. The directions in the black arrow leading from the negative should be followed. Thus, a normal negative should be printed on No. 2 paper. The proper choice of paper grade makes it possible to compensate for high or low negative density scale, while the use of the wrong paper grade results in prints that are too low or too high in contrast. In judging a wet print, it should be remembered that as prints dry they have slightly less contrast and appear darker than when wet. One can avoid having to estimate this effect by blotting the print and drying it with a fan. In addition, darkroom safelight illumination is not adequate for judging print quality; insufficient print contrast is especially difficult to detect.

CONTRAST VARIATIONS IN A GIVEN PAPER

It is advisable to become thoroughly familiar with the printing characteristics of each paper type that is commonly used. This is because paper types vary widely one from the other in important characteristics. For example, some papers, such as Kodabromide, have a relatively fixed contrast capacity in any given paper grade in spite of exposure and development variations. On the other hand, some contrast variation is possible in papers such as Kodak Opal or Ektalure which come in only a single grade. As a matter of fact, these two papers offer a great deal more flexibility in contrast control than might be superficially apparent. In general, the contrast range is dependent upon the kind of development that the papers receive. This can be demonstrated with Kodak Opal Paper, by developing it in different ways as described below, to produce a wide range of contrasts. The contrast differences between successive development steps are less, however, than the spacing between two adjacent grade numbers, but these control techniques are nevertheless helpful in obtaining the exact contrast match desired between negative and print. (It should be noted that exposure compensations are necessary in order to produce prints of similar density.) Developing temperature: 68 F (20 C).

1. Develop for only 1½ minutes in Kodak Selectol-Soft Developer.

2. Develop for 2 minutes in Kodak Selectol-Soft Developer.

3. Develop for 1 minute in Selectol-Soft Developer and 1 minute in Kodak Selectol Developer diluted 1 to 1.

4. Develop in Selectol Developer diluted 1 to 1 for the recommended time of 2 minutes.

5. Develop for 2 minutes in Selectol Developer Stock Solution. This results primarily in a colder image tone than the previous procedure, with a contrast increase that is more "apparent" than "actual."

As a general guide, it should be noted that the contrast capacity of Opal Papers developed in Selectol-Soft Developer is approximately one grade softer than when processed in Selectol Developer. Also of significance with development in Selectol-Soft Developer is a speed loss which amounts to approximately 20 percent less than when the print is developed in Selectol Developer.

The contrast of prints made on Kodak Medalist Paper (which is available in several grade numbers) will vary even more, depending upon the degree of development. Simply by varying the exposure and development time, a particular printing grade may be used to yield results that are normal, softer, or harder by approximately half a paper grade. Thus, Kodak Medalist Paper can be manipulated to cover the entire range from hard negatives to soft negatives, with precise matching of negative and paper for optimum quality in every enlargement.

Normally, Kodak Opal Paper is considered as a single normal contrast grade. This paper is intended for professional users who control rather carefully the lighting contrasts of their subjects and the characteristics of their negatives. However, a considerable range of contrasts can be produced through manipulation of the developer and exposure conditions.

(No. 1) (No. 2)

(No. 3) (No. 4)

These four prints were made from a single negative on Kodak Opal Paper. Print No. 1 was processed in Kodak Selectol-Soft Developer for 2 minutes. Print No. 2 was processed for 1 minute in Selectol-Soft Developer and then for 1 minute in Kodak Selectol Developer diluted 1 to 1. Print No. 3 was processed in Selectol Developer diluted 1 to 1 for 2 minutes. Print No. 4 was processed in Selectol Developer stock solution for 2 minutes.

PHOTOMETRIC METHODS OF PRINT CONTROL

The question arises: Can prints be made by measurement as far as the paper grade and exposure time are concerned? This question is of particular interest to photographers who print at such infrequent intervals that they do not retain their skill in judging negatives or in estimating printing time. It can be answered roughly thus: A high percentage of consistently good prints can be turned out by measurement. Photofinishing printers which have built-in measuring devices make excellent prints by measurement. Incidentally, good portrait prints are made through measurement by large-scale operators. When a conventional contact printer or enlarger is used, however, a photometer or a densitometer, such as the Kodak Color Densitometer, Model 1, is needed, and the photographer must decide for himself whether or not such an approach is worth while for his conditions.

The Kodak Color Densitometer can be used to check negative exposure and development levels. In addition it can determine the actual printing exposure for any new negative.

THE DENSITOMETER IN USE

The first thing which can be accomplished through the use of a densitometer is the determination of the paper grade required by the density scale of the negative. To determine the density scale of a negative, the shadow density or the lightest part of the negative where detail is required should be read and recorded. This shadow density is then subtracted from the recorded highlight density; the difference between them is the density scale of the negative. For example:

Highlight Density	1.62
Shadow Density	0.32
Density Scale	1.30

Objects with brilliant surfaces, such as metal, glassware, plastic objects, etc., which may reflect specular highlights into the negative should not be considered as the "highlight" in the negative. These very bright reflections, which contain no detail at all, should reproduce as white in the print. The highlight to be measured is the one in which detail is to be retained.

After the density scale of the particular negative has been determined, it is used as the basis for selecting the most suitable printing grade of the desired Kodak paper. On the average, the most pleasing prints will be obtained if the scale index of the paper is related to the density scale of the negative in accordance with the table on page 13.

The second thing which can be determined through measurement is the print exposure time. The procedure is as follows: After the appropriate grade has been determined by means of the densitometer, the first print should be made by trial and error to find the correct exposure time. The exposure time to produce the optimum print is closely correlated with the density reading of the negative's shadow area. Although highlight densities are sometimes used in determining the print exposure time for formal portraits made under closely controlled studio conditions, the relative shadow densities are usually preferred for general subjects, including informal portraiture.

After measuring the shadow density, the exposure time for any subsequent negative can be determined from any density-opacity conversion table. However, the Kodak Enlarging Dataguide will give this information in a convenient form. With it, densities will not have to be converted to opacities to be useful, since the Kodak Enlarging Dataguide can be read directly from the relative densities themselves. Thus, the exposure time for any number of negatives can be determined in the above way if all the negatives print on the same grade

and type of paper. However, if a different grade or type of paper is to be used, the test procedure of finding the best print exposure by trial and error will have to be repeated. Further than this, it must not be assumed that all batches of the same paper have exactly the same speed. Papers of a single type and grade have potential differences from batch to batch caused by differences in storage conditions, age, and other factors. Test prints are therefore advisable whenever a paper of a different emulsion number is used. If a different type of Kodak paper is used, consult the speed values in the data pages. This will help determine approximately the exposure for the new paper and will at least provide a helpful starting basis for a new test. It is thus that the Enlarging Computer in the *Kodak Master Darkroom Dataguide* can provide the photographer with exposure times, without the necessity for test prints, for any negatives which require the same paper grade. In addition, the Enlarging Computer is useful in finding the exposure if the magnification or the lens opening has been altered.

A densitometer can also be used to check negative exposure. The procedure is to make a reading of the clear edge of the film and record it. The density of the shadow area (the lightest part of the negative where detail is required) is also read and recorded. The first reading is then subtracted from the second. The difference should be at least 0.05. If less than that, the negative is seriously underexposed, and it cannot be expected to produce a print of optimum quality. The purpose of the first reading is to measure the density of the film support (base density) and the small amount of fog that is always present due to development. Such a measurement is called a "base + fog" density determination. Although the minimum shadow reading should be at least 0.05 above the base + fog density, a better negative would be obtained with improved printing characteristics if the difference were in the neighborhood of 0.15 to 0.2. It is always advisable to make this minimum image determination, especially when testing a new film material or using any new film-developer combination. If the shadow densities are found to be consistently low, the remedy would be to increase the negative exposure. To make an appreciable difference in this reading, the exposure should be doubled. Development should not be altered to effect this change in shadow density, since this is primarily a function of exposure. The base + fog density need not be measured to determine the density scale of a negative. This is because it will automatically be a part of both highlight and shadow readings and, as such, will cancel itself in any subsequent calculations.

PHYSICAL CHARACTERISTICS

Among paper characteristics termed "physical," image tone, surface, weight, and coating of the paper stock are especially important.

IMAGE TONE

The color of the silver deposit in the finished print is referred to as "image tone." If brownish, the print is said to be "warm" in tone, and if blue-black, it is described as "cold." These differences in color are caused by variations in size and condition of the silver grains which form the image, and they are controlled by the emulsion composition and the conditions of development. Kodak Velox Paper normally develops to a cold, blue-black image, while Kodak Azo, Opal, and Athena Papers, with normal handling, are progressively warmer in image tone.

Kodak papers are here grouped according to warmth of tone.

TONE	KODAK PAPER
BLUE-BLACK	Velox Velox Rapid Velox Unicontrast, Rapid Velite
NEUTRAL-BLACK	Ad-Type Azo Super Speed Direct Positive Kodabromide Resisto Resisto Rapid
WARM-BLACK	Polycontrast Rapid Medalist Illustrators' Azo Aristo Mural Polycontrast
BROWN-BLACK	Opal Ektalure Illustrators' Special Portrait Proof Athena Translite Enlarging

The warmth of tone of the papers listed as "Warm-Black" or "Brown-Black" can be varied considerably by changes in the developer. Kodak Dektol Developer and Kodak Developer D-72 produce comparatively cold tones, while Kodak Selectol Developer, Kodak Selectol-Soft Developer, and Kodak Developer D-52 yield warm tones.

SURFACE CHARACTERISTICS

Texture, or surface roughness, largely determines the fineness of print detail – the smoother the surface, the finer the detail.

1. *Smooth* paper has no noticeable surface pattern to interfere with the rendition of fine detail. This surface is best for small prints.
2. *Fine-Grained* paper has a slightly pebbled surface which adds richness to a print without much loss of definition. It is generally satisfactory for exhibition prints, views, and portraits of young people.
3. *Rough* paper has a noticeable texture which tends to subdue fine detail and emphasize the larger masses and planes of the subject. It is often useful for character studies, portraits of elderly people, and landscapes not dependent upon fine detail for interest.

Gloss, or surface sheen, largely determines print density scale – the glossier the surface, the blacker the maximum density and the greater the possible range of tones in the print.

1. *Glossy* (smooth) paper exhibits maximum density scale and fineness of detail. It should be used for prints intended for reproduction and for those in which extremely fine detail is important.
2. *High Lustre* surfaces offer the maximum reflection scale possible without ferrotyping. It falls between the glossy and lustre surfaces in scale.
3. *Lustre* surfaces, with a somewhat shorter density scale than glossy papers, are generally more pleasing for exhibition and general use.
4. *Matte* surfaces have the shortest density scale and subdue the overall contrast of the print. This is often desirable with high-key pictures and "atmospheric" landscapes.

Tint refers to the color of the paper stock. Some Kodak papers are supplied with a cream-white and old-ivory tinted stock, whereas others are supplied with a white stock only.

1. *White* should usually be used for cold-tone subjects. It is recommended for snow scenes and seascapes, for high-key subjects, and for prints to be toned blue.
2. *Cream white* is probably the best choice for general use. It is suitable for both sunlighted and artificially lighted scenes.
3. *Old ivory* is buff in color. It is effective in giving warmth and sunniness to all subjects. It adds richness to sunsets, to scenes suggesting lamplight or firelight, to character studies of elderly people, etc.

SPECIAL SURFACES

Silk paper, with a clothlike, glossy texture, is effective for still life's and many snow and water scenes. It has a cream-white tint.

Tweed paper, with a very rough, lustre surface, is recommended only for subjects requiring great subordination of detail. Imparting restraint and dignity, it is most effective in large print sizes. It is available with an old-ivory or cream-white tinted stock.

Tapestry paper has an extremely rough, lustre surface which greatly subordinates detail and is suitable only for large prints and massive subjects.

Suede paper has a smooth, extremely matte surface. Its short density scale suits many high- and low-key pictures, including both portraits and pictorials. Framed without glass, this paper shows no surface reflection. It is supplied in cream-white.

Thickness. Depending on thickness of paper stock, most Kodak papers are classified as Single Weight or Double Weight. Single-weight paper is satisfactory for small prints. Double-weight paper is preferable for larger prints. Some papers are furnished in light weight for special purposes.

Baryta coating, as mentioned previously, is a sizing layer, generally consisting of barium sulfate in a suitable vehicle; it is applied to the paper stock to form a foundation for the emulsion and to increase the reflecting power of the paper. Most Kodak light-sensitive papers have this baryta coating. Exceptions are those papers identified by the letters A and SA, which are intended for purposes which frequently involve folding and mailing; elimination of the baryta coating permits them to be folded without cracking.

Paper surface selection is definitely related to subject type and mood. Here, a high-sheen surface such as Medalist Y should be used to help create a sparkling snow effect.

WHAT SURFACE TO CHOOSE?

The following is a brief description of each type of Kodak paper surface, with some of its most common applications.

Surface A is a smooth, lustrous surface on a white, light-weight folding stock. It is used frequently for French-fold greeting cards, prints to be attached to reports and theses, salesmen's sample picture books, and paper negatives.

Surface B is smooth, cream-white, lustre, particularly appropriate for portraits of small heads where it is desirable to preserve fine detail.

Surface C is the matte counterpart of B. It, too, is used for small portrait heads, but it is also recommended for high-key pictures where the matte surface adds a feeling of delicacy.

Surface D is a high-lustre, "snow-white" surface which is ideal for snow scenes and the production of Christmas cards.

Surface E is a fine-grain lustre on white stock. It is usually preferred where a commercial paper of a non-glossy type is indicated. It preserves a great amount of detail. Its white stock tint makes it acceptable to the engraver, and its lustre finish makes it desirable as an all-round paper.

Surface F is Kodak's glossy surface – the general favorite for pictures to be reproduced photomechanically, such as commercial photos, news photos, etc. It is also widely used for exhibition prints, because of its ability to reproduce a maximum of detail with brilliance. The F surface is by far the most popular paper in both the commercial and photofinishing fields.

Surface G is the outstanding favorite for portraiture. It is adaptable to the majority of subjects and is often considered a happy balance in cases where a more appropriate surface is not at hand. This surface is the popular favorite for oil coloring.

Surface J is a smooth, high-lustre white. Designed specifically for the illustrator, its high-lustre surface preserves detail and produces brilliance which facilitates the making of highest-quality photochemical reproductions. If desired, this surface can be ferrotyped.

Surface K is the high-lustre counterpart of G and is designed for the same purposes as G, although it imparts a feeling of greater brilliance and life to the picture. It is not recommended for oil coloring.

Surface L, being rough, is intended for reasonably large heads or other subjects where fine detail is not important. The rough texture adds a certain ruggedness to the print and makes large-size photographs appear somewhat richer than if printed on a smooth surface.

Surface N is a commercial surface which has been especially designed for retouching on the print. It accepts strong penciling. Being quite smooth, it also preserves fine detail.

Surface P is the old-ivory counterpart of G and is used for the same purposes except that it is recommended for subjects with warmth, such as fireside scenes, sunsets, etc. The old-ivory tint is also felt by many photographers to add stature to portraits of men, particularly older men.

Surface R is the very popular tweed surface. It is effective in minimizing the need for fine retouching and is especially good for breaking up large areas with its tweedlike texture. This surface has proven very popular for portrait proofing and for photomural work.

Surface V is the popular suede which simulates the appearance of suede leather. The extreme matte tends to tone down some detail, and the deep suede effect adds considerable depth to subjects. The suede surface is practically reflection-free and looks very well with almost any type of lighting. It has been of considerable interest to television advertisers in their attempts to eliminate surface glare. It has also been adopted by several outstanding photographers for highest-quality wedding photographs.

Surface X features a lustre tapestry surface, the same as Surface Z except on a cream-white base.

Surface Y simulates silk and is extremely popular for wedding photography because of its brilliance and clothlike texture. Its brilliance also makes it a very attractive medium for expressing brightness in such pictures as snow scenes, seascapes, greeting cards, etc.

Surface Z is extremely coarse-textured and canvaslike. It is a heavy surface designed for the printing of heavy subjects. Its major use is for subduing large masses and it is very effective for extremely large heads of men. Opal Z is frequently oil-colored with opaque oils, which gives much the effect of an oil painting on canvas.

To retain the sun-through-the-smoke effect, try Opal P which has an old-ivory paper base.

DIMENSIONAL STABILITY

The term "dimensional stability" may refer to two rather different characteristics. One has to do with the magnitude of changes in size; the other with the uniformity from one sheet to another.

Paper is not a dimensionally stable material. All photographic papers undergo small but measurable changes in size as a result of processing and drying, and of variations in relative humidity. In a dry condition, the sheet of paper will be smaller than it will be in a more moist condition. Moreover, when passing from a dry condition to a wet condition and back to the same dry condition, the sheet may not return to its original dimensions. Regardless of this situation, photographic paper is expected to be usable under wide extremes of humidity in exposing equipment, which is usually built with rigid paper guides set to predetermined dimensions. It becomes immediately obvious that a sheet of paper can expand beyond the guide dimensions or shrink below them, so that the paper will be either too large or too small and off center. To cope with this situation, paper is usually cut in equilibrium with average humidity conditions, and the equipment guides are adjusted accordingly. Once a sheet of paper is cut, the dimensions may increase or decrease as much as 0.3 percent for each 10 percent change in relative humidity.

Cutting is in conformance with American Standards and in most sizes is from one direction of the grain. Special orders, such as undercut paper to fit film holders or cutting from a different grain direction, will be considered unlisted, and special pricing and minimum-order requirements will apply.

Changes in size in the cross direction of the sheet are generally greater than in the machine direction (the direction in which the master roll was made on the paper-making machine). Because of paper's inherent instability, attention is concentrated on keeping changes in size uniform from one sheet of Kodak paper to another.

It is sometimes necessary to use several sheets of paper when making an unusually big enlargement. The separate prints must be uniform in any size changes they undergo so that they will match when the large composite print is assembled. The dimensional changes will be closely similar for consecutive sheets of Kodak papers taken from the same box, and thus will permit close matching of the prints. Maximum fidelity is obtained when the paper is used in the same direction (either machine or cross direction) for each separate print, and when processing and drying are done under identical conditions.

Kodak Resisto and Resisto Rapid Papers have a water-resistant base. Although they are not completely dimensionally stable, when processed as recommended they retain their original size better than other photographic papers due to short processing times.

PERMANENCE

With recommended processing, including recommended washing procedures, prints made on Kodak papers can be expected to last for many years without undergoing noticeable change. Residual silver salts in the print in time cause staining. Accordingly, for prints which are to be stored for many years, it is advisable to use two fixing baths, the second being freshly made (see "Fixing," page 44).

Very small traces of hypo retained in prints greatly accelerate the rate of fading of the image. Accordingly, for long-term storage, when complete removal of hypo is important, prints should be treated in Kodak Hypo Eliminator HE-1. For further increasing the permanence of a print image, Kodak Gold Protective Solution GP-1 can be used. Formulas for these solutions are found in the Kodak Data Book, "Processing and Formulas," which also contains on page 36 sections on *Testing for Hypo* and *Testing for Silver Salts*. In addition, to help insure maximum life, prints should be stored in a cool, dry place which is free from all chemical and paint fumes.

Kodak Dry Mounting Tissue and Kodak Rapid Mounting Cement are recommended for use with photographic prints. Mounting materials, both adhesives and supports, not specially made for photographs may contain harmful substances.

PROCESSING

DARKROOM ILLUMINATION

SAFELIGHT LAMP RECOMMENDATIONS
Minimum distance from lamp to work area is four feet

Name	Description	Kodak Safelight Filter Wratten Series	Bulb Size
Brownie Darkroom Lamp, Model B	Approximately cylindrical. Screws into light socket.	0 (Yellow) Side, 3 x 4 in. End, 2½-in. circle	7-watt
Kodak 2-Way Safelamp	Two sided. Screws into light socket.	0A, 0C, 1A 3¼ x 4¾-in.	15-watt
Kodak Darkroom Lamp	Parabolic, hung on drop cord over bench or sink.	0A, 0C, 1A 5½-in. circle	15-watt
Kodak Adjustable Safelight Lamp	Parabolic, on standard. For use on a table or mounted on a wall.	0A, 0C, 1A 5½-in. circle	15-watt
Kodak Utility Safelight Lamp, Model C	Suspended from ceiling by chains. With Accessory Bracket, used on table or shelf, or mounted on wall.	0A, 0C, 1A 10 x 12-in.	25-watt at ceiling, 15-watt used on table or shelf

The Wratten Series 0A Filter is for use with contact and enlarging papers, while the Series 0C is for use with high-speed enlarging papers. The Wratten Series 1A is for use with Kodalith Materials, Kodagraph Contact Paper, and Kodak Electrocardiogram Film.

In time, filters may become faded, discolored, or even cracked, which may cause print highlights to be veiled with fog. A simple maintenance type of check should be made periodically as follows: Turn off all safelights and expose for a normal enlargement on Kodabromide Paper. Cover the exposed sheet and turn on the safelights. Then move the paper to a location near the developing tray. Leave one-half of the paper covered, and expose parts of the other half to the safelights under average working conditions for 30 seconds, 1 minute, and 2 minutes, respectively. Develop the print and compare the two halves. If the highlights in the safelight-exposed half are degraded, check the condition of the safelights, their distance from the working surface, and lamp wattage.

DEVELOPERS

Correct processing of contact and enlarging papers is more certain if the manufacturer's recommendations, based on exhaustive research, are followed carefully.

Recommendations for the use of Kodak Dektol Developer, Kodak Ektonol Developer, Kodak Selectol Developer, and Kodak Developers D-72 and D-52 appear in the Data Sheets. Other developers which can be used are Kodak Universal M-Q Developer (supplied in convenient packets), Kodak Versatol Developer, and Kodak Selectol-Soft Developer.

Development Time. Excellent prints are possible only when the printing exposure is such that proper print density is produced in approximately the recommended development time. A common cause of "muddy" prints is underdevelopment. There is a natural tendency to pull out a rapidly darkening print before development is completed, but the image is then poor in tone, lacking in contrast, and often mottled from uneven development. Exposure *must* be carefully timed to suit development.

Some papers, such as Kodabromide, having more development latitude than others, require less critically timed exposure.

Overdevelopment, especially in an overworked solution, causes the formation of developer oxidation products which are likely to cause a yellow stain. Oxidation may also result from other causes, such as exposing the developing print to air. Processing stains, even in slight degrees, degrade print quality.

Uniform Development. The developing tray should be somewhat larger than the print. This allows proper agitation and convenience in handling the prints. Kodak trays are made with this need in mind; for example, an "8 by 10-inch" tray actually measures about 9 by 11 inches. The exposed print is slipped edgewise and face up into the developer solution so that it is covered quickly and evenly. The solution should be agitated by rocking the tray or by keeping the prints in motion. The prints must be kept completely immersed during development.

STOP BATH

After development, the print should be immersed for about 5 to 10 seconds in a stop bath, such as Kodak Indicator Stop Bath or Kodak Stop Bath SB-1, at 65 to 70 F (18 to 21 C) and agitated to insure thorough access of the solution to all parts of the print. If the stop

bath is made much stronger than the Kodak SB-1 formula, or if prints are left in the stop bath considerably longer than necessary, a mottled, "soaking" effect may result.

The Kodak Testing Outfit for Print Stop Baths and Fixing Baths provides a simple test for determining definitely when the stop bath is exhausted. Kodak Indicator Stop Bath, which is supplied as a concentrated liquid, changes color when it is neutralized and thus indicates automatically when the stop bath should be discarded.

FIXING

The print should be transferred quickly to stop and fixing baths, without any intermediate examination. After the prints have been rinsed carefully in the stop bath, they should be fixed for 5 to 10 minutes at 65 to 70 F (18 to 21 C) with agitation in an acid hardening fixing bath, such as a solution prepared from Kodak Acid Fixer or made from the formula for Kodak Fixing Bath F-5 or F-6. F-6 is recommended for general use; F-5, if prints tend to stick to ferrotype plates, belts, drums, or drier, or to soften in the toning bath. Kodafix Solution (diluted 1:7) and Kodak Rapid Fixer with Hardener (diluted 1:7) are also recommended. As single baths, these solutions will fix up to 100 8 x 10-inch prints (or their equivalent in other sizes) per gallon (4 liters) for general use.

By far the best and most economical practice is to use two fixing baths in succession. A two-bath system not only gives a much more permanent print, but the fixing solution can be used for many more prints.

Have both baths at 65 to 70 F (18 to 21 C). Fix the prints, with frequent agitation, for 3 to 5 minutes in the first bath; drain for 5 seconds; then fix for 3 to 5 minutes in the second bath.

The two baths are "good" for two hundred 8 by 10-inch prints (or equivalent in other sizes) per gallon of the first bath. After that many prints have been fixed, discard the first bath, put the second in its place, and mix a new second bath. The new two-bath setup is then ready for two hundred more prints. After three more such changes, that is, when a total of one thousand 8 by 10-inch prints (or their equivalent in other sizes) have been fixed, discard both baths and start over again. In any case, solutions should be kept no longer than one week. If in doubt, discard the solutions earlier.

Prolonged fixing and high-temperature fixing should be avoided, particularly with warm-tone prints, because of the tendency of the bath to bleach the image and change its tone.

WASHING

The purpose of washing papers is to remove the fixing solution from both the emulsion and the paper base. If the hypo is not removed, it will gradually transform the black silver image into a white or yellowish one. Dissolved silver salts carried from the fix by prints must also be adequately removed or clear areas of prints will yellow. Prints that are not given some chemical treatment designed to accelerate washing should be washed for at least one full hour. Prints should not be soaked in the wash water overnight since bleaching and stains may result.

After fixing, Kodak Hypo Clearing Agent can be used to reduce washing time and to obtain more complete washing. Transfer the prints, with or without a previous rinse, to the clearing agent solution. Treat single-weight papers in the solution at least 2 minutes or double-weight papers at least 3 minutes, with agitation, at 65 to 70 F (18 to 21 C). Wash single-weight papers at least 10 minutes and double-weight papers at least 20 minutes with agitation and normal water flow. When Kodak Hypo Clearing Agent is used, the water temperature may be as low as 35 F. If the water temperature is maintained at 65 to 70 F (18 to 21 C), a higher degree of stability can be obtained than under normal one-hour washing without hypo clearing agent treatment.

Prints not treated in Kodak Hypo Clearing Agent Solution should be washed for at least one hour in running water at 65 to 70 F (18 to 21 C). Water warmer than 70 F tends to soften the emulsion and does not appreciably shorten washing time. The stream of water should not be allowed to fall directly on the prints. Place a tumbler or graduate in the tray, and let the water overflow from it into the tray. Wash water should move fast enough to fill the washing container 10 to 12 times an hour, and should keep the prints moving. Trays should not be loaded so full that prints mat together or proper washing will not take place. The Kodak Automatic Tray Siphon converts any ordinary tray into an efficient print washer which assures proper movement and agitation of the prints during washing.

TESTING FOR HYPO

Very small traces of hypo retained in prints greatly accelerate the rate of image fading. It may therefore be desirable to process a blank piece of paper along with the batch of prints, and then test it for hypo as follows:

KODAK HYPO TEST SOLUTION HT-2		
	AVOIRDUPOIS U. S. LIQUID	METRIC
Water	24 ounces	750 cc
*Kodak Acetic Acid, 28% .	4 ounces	125.0 cc
Kodak Silver Nitrate . .	¼ ounce	7.5 grams
Water to make	32 ounces	1.0 liter

Store in a screw-cap or glass-stoppered brown bottle away from strong light. Avoid contact of test solution with the hands, clothing, negatives, prints, or undeveloped photographic materials; otherwise black stains will ultimately result.

Testing Procedure. After washing, wipe the excess water from the face (emulsion side) of a blank piece of the same photographic paper processed with the batch of prints (or from the extra margin area of one of the prints). Place one drop of the test solution on the face of this processed paper sample. Allow the solution to stand on the paper sample for 2 minutes, rinse to remove the excess reagent, and then compare the stain with the tint patches found in the Kodak Data Book, "Processing and Formulas" to estimate the degree of washing. Excess silver nitrate left in the paper will darken on exposure to light.

Photographic prints which are to be stored under temperate climatic conditions may be considered satisfactorily washed when the hypo content is *Fair*. More severe storage conditions and documentary permanence require *Good* washing. These tolerances apply to many printing papers, but warm-toned portrait papers will require better washing, while line copy on bromide paper will allow greater hypo tolerance. In any case, if the stain is the same as or darker than the *Poor* rating, the print has not been washed sufficiently. *Note:* When hypo eliminators or washing aids have been used, the spot test may give misleading results since the face side may show less stain than prints washed only in water, although the total hypo content (in the emulsion plus the paper base) may be equal.

TESTING FOR SILVER SALTS

If prints are not adequately agitated and separated in the fixing bath, or if they are fixed in a used bath containing more than a small concentration of dissolved silver compounds, some silver salts will be retained in the paper and will be very difficult to remove by washing. Eventually, these silver salts may discolor, and the prints may be covered with the brownish stain of silver sulfide. The remedy is adequate two-bath fixing and thorough washing.

In case the presence of silver salts is suspected, they may be detected by the following test: Dilute one part Kodak Rapid Selenium Toner with nine parts of water. These proportions are not critical. After the customary fixing and washing, place a drop of the diluted solution in the clear margin on the emulsion side of a dry or squeegeed print. Remove after 2 minutes by careful blotting with a clean white blotter, such as Kodak Blotting Paper. For careful control, a standard test print should be made by processing a blank sheet of paper through two fresh fixing baths and washing thoroughly. The control test should then be made on this sheet. Any coloration in excess of a just-visible cream tint indicates the presence of silver compounds in the processed paper. The stain produced on a print is an indication of the stain that might be formed in the highlights with adverse storage conditions such as high temperature and high humidity over long periods of time. *Note:* This test fails where a very large excess of hypo is present in the paper.

DRYING

Generally, papers with an "F" designation should be prepared for ferrotyping by wiping carefully with a viscose sponge to remove any foreign material adhering to the wet emulsion. The prints should then be transferred to the drum or tin with a good quantity of surface water. The necessary contact between the paper and the drum is obtained by the roller pressure. (Note: We normally do not recommend the ferrotyping of the "J" surface.)

Prints not requiring ferrotyping should be dried in the Kodak Photo Blotter Roll, Kodak Professional Print Dryer, Model C, or on belt dryers. Prints may also be dried on clean cheesecloth or between clean blotters on plastic screen stretchers. Before drying by any of these methods, excessive water should be removed from the print to minimize print cockle. This may be accomplished by pressing the print between blotters prior to dryer application or by wiping the surfaces carefully with a viscose sponge, blotting paper, or similar material.

If prints curl after drying, they can be flattened by dampening their backs with water (or equal parts of alcohol and water), and then redrying them between blotters under heavy pressure for two or three hours. Kodak Print Flattening Solution can be used to minimize curling and possible cracking of the emulsion.

Cleanliness is of primary importance in the drying of photographic prints. It is possible for dirt or lint on the drying surface to mar an otherwise perfectly processed print.

TONING

The choice among the various papers offers a selection in the warmth of tone of the print, as discussed under "Image Tone," page 35. The warmth of tone of such papers as Kodak Azo and Kodak Medalist, can also be varied by the choice of the developer; for example, Kodak Selectol and Kodak D-52 Developers produce warmer tones than Kodak Dektol and Kodak D-72 Developers on such papers.

When a more definitely colored image is desired, it is usually necessary to submit the developed and fixed image to some process in which a color or tone is produced by replacement of the silver image with inorganic salts or with dyes. Toners for this purpose can be obtained in package form, or they can be prepared from formulas.

Toners which must be prepared by the user from formulas are given in the Kodak Data Book, "Processing and Formulas." The center fold of the Kodak Data Book, "Professional Printing with Kodak Photographic Papers," illustrates the results obtainable with various paper-toner combinations.

Yellow-brown corn shocks, autumn leaves, a warm sunny effect—all of which call for a sepia toned print. Be sure to note the helpful toning chart on page 65 for paper-toner recommendations.

Other Kodak Printing Materials

• In addition to the papers described in detail in this book, there are many Kodak papers and positive materials for special purposes. A few of these products are discussed below.

Kodak Illustrators' Special Paper has a full-scale, brilliant emulsion of the quality and speed of Kodak Ektalure Paper. It is a fine medium for commercial illustration and reproduction purposes, and the surface is well suited to retouching. It is supplied in single weight, double weight, and in a white, lustre, fine-grained surface.

Kodak Ad-Type Paper for contact printing has the same speed as Kodak Azo Paper. It is designed to fold without cracking and is an excellent medium for photographic greeting cards. Ad-Type Paper is coated on white, lustre, lightweight, smooth stock, and is supplied in six printing grades. It is also available in a ledger-type stock of good strength in four printing grades.

Kodak Translite Film is coated on both sides with a blue-sensitive emulsion of enlarging speed and is intended for making black-and-white transparencies to be viewed by transmitted light. Transparencies on Translite Film have a remarkable quality of roundness and depth. It is also useful for making enlarged negatives in paper-negative work.

Kodak Studio Proof Paper is a smooth, white, single-weight, printing-out proofing paper which requires sunlight or extremely brilliant artificial light for printing. It is supplied in surface F.

Kodak Opalure Print Film is a printing material having an emulsion similar to that of Kodak Opal Paper. It is coated on a white film base and is especially suitable for producing portrait and exhibition prints in either large or miniature sizes. It gives beautiful warm tones with direct development, its matte surface is ideal for hand coloring.

Kodak Portrait Proof Paper, which is single weight and has a tweed, lustre surface, is normally intended for making proofs from professional portrait negatives. It is slightly slower than Kodak Ektalure Paper. This is a developing-out, not a printing-out, paper.

Kodak Velox Premier Paper is a high-speed product especially designed for printing miniature negatives with diffused light sources.

Kodak Velox Rapid Paper is suitable for optical printers. It enables photofinishers to produce enlargements from miniature negatives of the same quality and tone as Velox contact prints. It hasn't sufficient

speed for use with conventional enlargers.

Kodak Velox Unicontrast Rapid Paper is a long scale paper for photofinishing roll printing and processing.

Kodak Super-Speed Direct Positive Paper provides a direct positive image by chemical reversal and is useful for making prints directly from transparencies. It can also be used in the camera. The emulsion is orthochromatic and has a short exposure latitude.

Kodak Panalure Paper is a black-and-white printing paper with panchromatic sensitivity. It is especially designed for making black-and-white prints from color negative films, such as Kodacolor, Kodak Ektacolor Film, Type S, and Kodak Ektacolor Film, Type L. Filters can be used at the enlarger to change gray scale rendering of color relationships in the final print.

Kodak Resisto Rapid Pan Paper is designed for making three-color separation positive prints with appropriate filters from Kodak Ektacolor and Kodacolor negatives.

MATERIALS FOR INDUSTRIAL USE

Materials for Drawing and Document Reproduction — The duplication of drawings, documents, and records is an indispensable part of business and industrial operations. The Eastman Kodak Company makes a line of photographic materials especially for this purpose. These materials, which are high-contrast emulsions coated on film and paper supports, offer the user a large range of products for doing almost any type of drawing- and document-reproduction job. These materials are available through Kodak Industrial Dealers.

CONTACT MATERIALS FOR ROOM-LIGHT HANDLING

Kodak Verifax Matrix Paper — For making on a Verifax printer, in normal room light, and within a minute's time multiple copies of letters and documents.

Kodagraph Autopositive Paper, Extra Thin and Translucent — High-contrast papers for making positive copies from positive originals. They are primarily used for reproducing engineering drawings.

Autopositive Paper, Translucent, has 30 percent greater print-back speed when used as an intermediate and is more translucent and more durable than Autopositive Paper, Extra Thin.

Kodagraph Autopositive Film — This has the same unique photographic characteristics as Kodagraph Autopositive Paper. It is a highly translucent safety film, and its dimensional stability makes it especially suitable for reproducing maps and drawings having very poor quality. Excellent for restoration and for extra-fine detail.

Kodagraph Repro-Negative Paper, Extra Thin – For making either black-on-white intermediates from blueprints and other negative originals or negatives of drawings. It can be handled in room light and exposed on standard reproduction equipment in the same manner as Kodagraph Autopositive materials.

CONTACT MATERIALS FOR DARKROOM HANDLING

Kodagraph Contact Paper – Available in four different paper stocks – Standard, Extra Thin, Fine-Line, Translucent. It is a high-contrast paper for reproducing drawings and documents. The Fine-Line stock has a baryta undercoat permitting the recording of extremely fine detail. The Translucent stock is especially suitable for making duplicate copies of engineering drawings.

PROJECTION-SPEED MATERIALS FOR DARKROOM HANDLING

Kodagraph Projection Paper, Standard and Extra Thin – For making high-quality enlargements from microfilm and other reduced-scale negatives. It can be handled under a Kodak Safelight Filter, Wratten Series 1A.

Kodagraph Fast Projection Paper, Standard and Extra Thin – For making high-quality enlargements from microfilm and other reduced-scale negatives where short exposure time is essential. Reproductions on the Extra Thin stock are suitable for making additional copies in blueprint and direct-process machines and are less bulky, reducing filing space.

KODAK PHOTORECORDING PAPERS

Kodak Linagraph papers and films are designed to record crisp, black line images on clean backgrounds with all leading makes of photographic-recording instruments. They are supplied in a wide range of photographic and mechanical specifications.

Kodak Linagraph 480 Paper – Made expressly for seismographs with sensitivity adequate for a good record in all photographic paper seismography.

Kodak Linagraph 483 Paper – Same emulsion as 480, but on an extra-thin base.

Kodak Linagraph 697 Paper – For recording traces on blue-emitting cathode-ray tubes.

Kodak Linagraph 809 Paper—A favorite paper for general oscillographic use. Has strong, ledger-type paper base.

Kodak Linagraph 1127 Paper – Of all recording papers, the most sensitive to tungsten light. Valuable for recording traces from green-emitting cathode-ray tubes.

Data—KODAK MEDALIST PAPER

Purposes: This is a truly versatile high-speed enlarging paper. The speeds of the contrast grades, from high to low, are similar. The contrast may be modified through variations in exposure and development.

Tone: Warm-black, ideal where something warmer than Kodabromide Paper is needed.

Grade, Speed, and Scale Index Value:

Grade	*Shadow Speed*	*Printing Index*	*Approximate Scale Index*	*Negative Density Scale*
1	500	2000	May be varied with development time within the "useful" range (see below).	High
2	650	2000		Normal
3	800	2000		Low
4	1000	2000		Very Low

Tint, Brilliance, Surface, Weight, Symbol, and Grade:

Tint	*Brilliance*	*Surface*	*Single Weight Symbol and Grades*	*Double Weight Symbol and Grades*
White	Glossy	Smooth	F, 1, 2, 3, 4	F, 2, 3
White	High Lustre	Smooth	J, 2, 3	J, 1, 2, 3, 4
Cream White	Lustre	Fine Grained		G, 1, 2, 3, 4
White	Lustre	Fine Grained		E, 2, 3
Cream White	Lustre	Silk		Y, 1, 2, 3

Safelight Recommendation: Kodak Safelight Filter, Wratten Series OA.

Development Recommendations: (at 68 F or 20 C)

Kodak Developer	*Dilution*	*Development Time in Minutes*		*Purpose*
		Recommended	*Useful Range*	
Dektol or D-72	1:2	1	¾ to 2	Normal Tones
Ektanol, Selectol, or D-52	1:1	2	1½ to 4	Warmer Tones
Selectol-Soft	1:1	2	1½ to 4	Lower Contrast

Acid Stop Bath: Rinse 5 to 10 seconds, with agitation, in Kodak Indicator Stop Bath or Kodak Stop Bath SB-1 at 65 to 70 F (18 to 21 C).

Fixing: Use Kodak Acid Fixer, Kodak Rapid Fixer, or Kodak Fixing Bath F-5 or F-6 at 65 to 70 F (18 to 21 C). For two-bath method, fix 3 to 5 minutes in each bath; for single-bath, 5 to 10 minutes.

Kodak Hypo Clearing Agent Treatment: See page 45.

Washing: After fixing, transfer the prints with or without rinsing, to a solution of Kodak Hypo Clearing Agent. Treat single-weight prints at least 2 minutes and double-weight prints at least 3 minutes with agitation at 65 to 70 F (18 to 21 C). Then wash single-weight prints at least 10 minutes and double-weight prints at least 20 minutes with agitation and normal water flow.

Prints not treated in Kodak Hypo Clearing Agent Solution should be washed for at least one hour in running water at 65 to 70 F (18 to 21 C).

Drying: All surface water should be removed with a viscose sponge to minimize drying cockle. Then place print on cheesecloth stretchers, between clean white photo blotters, or on a belt dryer. The F surface can be ferrotyped.

Data—KODAK EKTALURE PAPER

Purposes: This is a warm mellow-toned enlarging paper particularly well adapted to cold-light enlargers. Designed especially for coloring with transparent oil colors, the surface has been adjusted to accept oil colors readily.

Tone: Brown-black, a bit warmer than Opal Paper.

Grade, Speed, and Scale Index Value:

Grade	*Shadow Speed*	*Printing Index*	*Approximate Scale Index*	*Negative Density Scale*
Normal	320	800	1.3	Normal

Tint, Brilliance, Surface, Weight, and Symbol:

Tint	*Brilliance*	*Surface*	*Single Weight Symbol*	*Double Weight Symbol*
Cream White	Glossy	Smooth	F	F
Cream White	Lustre	Fine-Grained		G
Cream White	Lustre	Tweed		R
Cream White	Lustre	Tapestry		X
Cream White	Lustre	Silk		Y

Safelight Recommendations: Kodak Safelight Filter, Wratten Series OA.

Development Recommendations: (at 68 F or 20 C)

Kodak Developer	*Dilution*	*Development Time in Minutes*		*Purpose*
		Recommended	*Useful Range*	
Ektanol, Selectol, or D-52	1:1	2	1½ to 4	Normal Tones
Selectol-Soft	1:1	2	1½ to 4	Lower Contrast

Acid Stop Bath: Rinse 5 to 10 seconds, with agitation, in Kodak Indicator Stop Bath or Kodak Stop Bath SB-1 at 65 to 70 F (18 to 21 C).

Fixing: Use Kodak Acid Fixer, Kodak Rapid Fixer, or Kodak Fixing Bath F-5 or F-6 at 65 to 70 F (18 to 21 C). For two-bath method, fix 3 to 5 minutes in each bath; for single-bath, 5 to 10 minutes.

Kodak Hypo Clearing Agent Treatment: See page 45.

Washing: After fixing, transfer the prints with or without rinsing, to a solution of Kodak Hypo Clearing Agent. Treat single-weight prints at least 2 minutes and double-weight prints at least 3 minutes with agitation at 65 to 70 F (18 to 21 C). Then wash single-weight prints at least 10 minutes and double-weight prints at least 20 minutes with agitation and normal water flow.

Prints not treated in Kodak Hypo Clearing Agent Solution should be washed for at least one hour in running water at 65 to 70 F (18 to 21 C).

Drying: All surface water should be removed with a viscose sponge to minimize drying cockle. Then place print on cheesecloth stretchers, between clean white photo blotters, or on a belt dryer.

Data—KODAK MURAL PAPER

Purposes: This is an enlarging paper created specifically for giant photomurals. To withstand the folding and handling often necessary in processing large prints, it has extra strength and abrasion resistance.

Tone: Warm-black, slightly warmer than Kodabromide . . . well suited to mural work.

Grade, Speed, and Scale Index Value:

Grade	*Shadow Speed*	*Printing Index*	*Approximate Scale Index*	*Negative Density Scale*
2	650	2000	1.3	Normal
3	800	2000	1.1	Low

Tint, Brilliance, Surface, and Weight: R (cream white, lustre, tweed), Single Weight.

Safelight Recommendation: Kodak Safelight Filter, Wratten Series OA.

Development Recommendations: (at 68 F or 20 C)

Kodak Developer	*Dilution*	*Development Time in Minutes*		*Purpose*
		Recommended	*Useful Range*	
Ektonol, Selectol, or D-52	1:1	2	1½ to 4	Normal Tone
Ektonol, Selectol, or D-52	1:3	4	3 to 8	Large Murals
Selectol-Soft	1:1	2	1½ to 4	Lower Contrast
Dektol or D-72	1:4	2	1½ to 4	Cooler Tones
	1:2	1	¾ to 2	Cooler Tones

Acid Stop Bath: Rinse 5 to 10 seconds, with agitation, in Kodak Indicator Stop Bath or Kodak Stop Bath SB-1 at 65 to 70 F (18 to 21 C).

Fixing: Use Kodak Acid Fixer, Kodak Rapid Fixer, or Kodak Fixing Bath F-5 or F-6 at 65 to 70 F (18 to 21 C). For two-bath method, fix 3 to 5 minutes in each bath; for single-bath, 5 to 10 minutes.

Kodak Hypo Clearing Agent Treatment: See page 45.

Washing: After fixing, transfer the prints with or without rinsing, to a solution of Kodak Hypo Clearing Agent. Treat single-weight prints at least 2 minutes and double-weight prints at least 3 minutes with agitation at 65 to 70 F (18 to 21 C). Then wash single-weight prints at least 10 minutes and double-weight prints at least 20 minutes with agitation and normal water flow.

Prints not treated in Kodak Hypo Clearing Agent Solution should be washed for at least one hour in running water at 65 to 70 F (18 to 21 C).

Drying: All surface water should be removed with a viscose sponge to minimize drying cockle. Then place print on cheesecloth stretchers, between clean, white photo blotters, or on a belt dryer.

Data—KODAK OPAL PAPER

Purposes: Opal has ample speed for enlarging with fast equipment. It is ideal for projection prints and can be used for contact prints from paper negatives or from original negatives of normal contrast, by using reduced printing illumination. Opal is excellent for exhibition prints.

Tone: Brown-black; Opal's warmth of image tone can be controlled within certain limits by varying the exposure and development time. It responds quite well to developer manipulation. **Grade and Scale Index Value:** Opal is supplied in one grade only for normal negatives. Approximate scale index 1.3.

Speed: Shadow Speed – 200, Printing Index 650.

Tint, Brilliance, Surface, and Symbol: Double Weight

Tint	*Brilliance*	*Surface*	*Symbol*	*Tint*	*Brilliance*	*Surface*	*Symbol*
Cream White	Lustre	Smooth	B	Old Ivory	Lustre	Fine Grained	P
Cream White	Matte	Smooth	C	Cream White	Lustre	Tweed	R
Cream White	Lustre	Fine Grained	G	Cream White	Matte	Suede	V
Cream White	High Lustre	Fine Grained	K	Cream White	Lustre	Silk	Y
Cream White	Lustre	Rough	L	Old Ivory	Lustre	Tapestry	Z

Safelight Recommendation: Kodak Safelight Filter, Wratten Series OA.

Development Recommendations: (at 68 F or 20 C)

Kodak Developer	*Dilution*	*Recommended Time*	*Useful Range*	*Purpose*
Ektanol, Selectol, or D-52	1:1	120 sec	90 to 240 sec	Warm Tones
Selectol-Soft	1:1	120 sec	90 to 240 sec	Lower Contrast

Acid Stop Bath: Rinse 5 to 10 seconds, with agitation, in Kodak Indicator Stop Bath or Kodak Stop Bath SB-1 at 65 to 70 F (18 to 21 C).

Fixing: Use Kodak Acid Fixer, Kodak Rapid Fixer, or Kodak Fixing Bath F-5 or F-6 at 68 to 70 F (18 to 21 C). For the two-bath method, fix 3 to 5 minutes in each bath; for single-bath, 5 to 10 minutes.

Kodak Hypo Clearing Agent Treatment: See page 45.

Washing: After fixing, transfer the prints with or without rinsing, to a solution of Kodak Hypo Clearing Agent. Treat single-weight prints at least 2 minutes and double-weight prints at least 3 minutes with agitation at 65 to 70 F (18 to 21 C). Then wash single-weight prints at least 10 minutes and double-weight prints at least 20 minutes with agitation and normal water flow.

Prints not treated in Kodak Hypo Clearing Agent Solution should be washed for at least one hour in running water at 65 to 70 F (18 to 21 C).

Drying: All surface water should be removed with a viscose sponge to minimize drying cockle. Then place print on cheesecloth stretchers, between clean white photo blotters, or on a belt drier.

Data—KODABROMIDE PAPER

Purposes: Kodabromide is an enlarging paper well suited to the making of exhibition prints which require brilliant and rich blacks. Its speed makes its use practical with any type of enlarger. Additional features include a long-scale emulsion, five grades, wide latitude in exposure and development, and a physically hardened emulsion, all of which make it ideal as a general-purpose enlarging paper. Kodabromide F Grade 1, N, or A, single weight, are recommended for positives and negatives for the paper negative process.

Tone: Neutral-black, uniform through all grades and especially uniform for a wide range of development times.

Grade, Speed, and Scale Index Value:

Grade	*Shadow Speed*	*Printing Index*	*Approximate Scale Index*	*Negative Density Scale*
1	1600	5000	1.5	High
2	1250	3200	1.3	Normal
3	1000	2000	1.1	Low
4	800	1250	0.9	Very Low
5	650	1000	0.7	Extremely Low

Tints, Brilliance, Surface, Weight, Symbol, and Grade:

Tint	*Brilliance*	*Surface*	*Single Weight Symbol and Grades*	*Double Weight Symbol and Grades*
White	Glossy	Smooth	F No. 1, 2, 3, 4, 5	F No. 1, 2, 3, 4, 5
White	Lustre	Smooth	N No. 1, 2, 3, 4, 5	N No. 1, 2, 3, 4
White	Lustre	Fine Grained	E No. 1, 2, 3, 4, 5	E No. 1, 2, 3, 4, 5
White	Lustre	Smooth	*Light Weight* No. 1, 2, 3, 4, 5	
Cream White	Lustre	Fine Grained		G No. 1, 2, 3, 4, 5

Safelight Recommendation: Kodak Safelight Filter, Wratten Series OA.

Development Recommendations: (at 68 F or 20 C)

Kodak Developer	*Dilution*	*Recommended Time (in seconds)*	*Useful Range (in seconds)*	*Purpose*
Dektol or D-72	1:2	90	60 to 180	Normal Development

Acid Stop Bath: Rinse 5 to 10 seconds, with agitation, in Kodak Indicator Stop Bath or Kodak Stop Bath SB-1 at 65 to 70 F (18 to 21 C).

Fixing: Use Kodak Acid Fixer, Kodak Rapid Fixer, or Kodak Fixing Bath F-5 or F-6 at 65 to 70 F (18 to 21 C). For the two-bath method, fix 3 to 5 minutes in each bath; for the single-bath, 5 to 10 minutes.

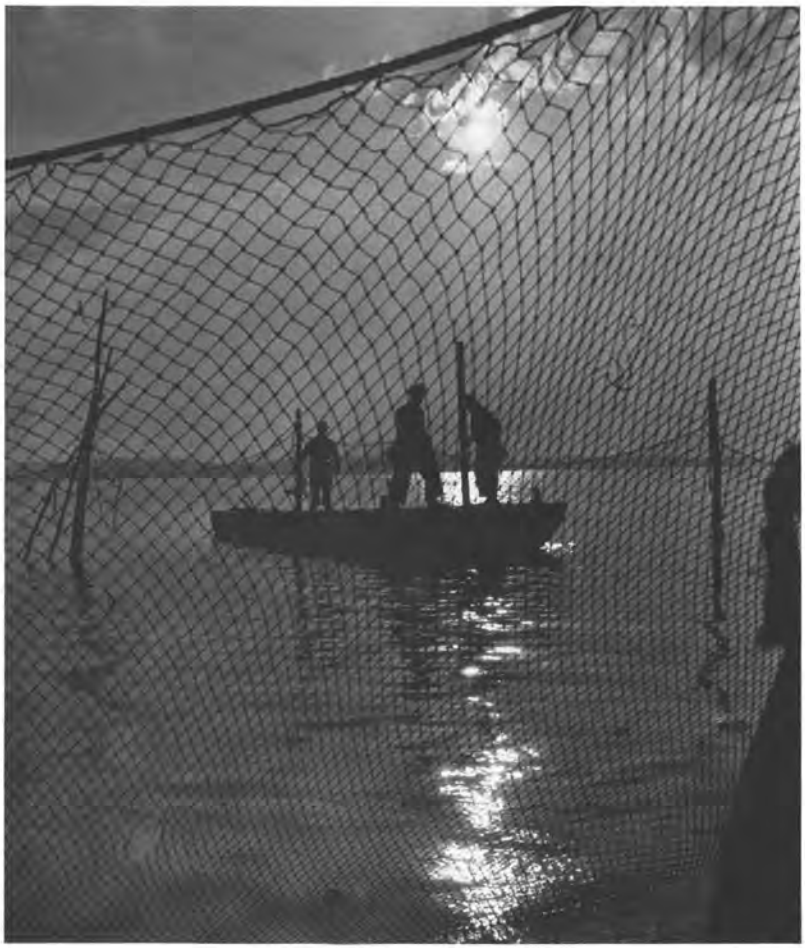
Kodak Hypo Clearing Agent Treatment: See page 45.

Washing: After fixing, transfer the prints with or without rinsing, to a solution of Kodak Hypo Clearing Agent. Treat single-weight prints at least 2 minutes and double-weight prints at least 3 minutes with agitation at 65 to 70 F (18 to 21 C). Then wash single-weight prints at least 10 minutes and double-weight prints at least 20 minutes with agitation and normal water flow.

Prints not treated in Kodak Hypo Clearing Agent Solution should be washed for at least one hour in running water at 65 to 70 F (18 to 21 C).

Drying: Glossy prints can be ferrotyped. All surface water should be removed with a viscose sponge to minimize drying cockle. Then place prints on cheesecloth stretchers, between white photo blotters, or on a belt drier.

Exposure and Development Latitude: Kodabromide is noted for an exceptionally wide latitude both in exposure and development.



Data—KODAK VELITE PAPER

Purpose: Velite is a contact printing paper which can be handled and processed in ordinary room light and in subdued daylight. Exposure for average negatives would be about 3 seconds for No. 1 flood lamp placed 8 inches from printing frame.

Tone: Blue-black, similar to Velox.

Grade, Speed, and Scale Index Value:

Grade	*Shadow Speed*	*Printing Index*	*Approximate Scale Index*	*Negative Density Scale*
Normal	0.8	3	1:3	Normal

Tint, Brilliance, Surface, Symbol, and Weight:

Tint	*Brilliance*	*Surface*	*Symbol and Weight*
White	Glossy	Smooth	F, Single Weight

Safelight Recommendation: 60-watt tungsten lamp at 5 feet. (Approximately 3½ foot candles.)

Development Recommendations: (at 68 F or 20 C)

Kodak Developer	*Dilution*	*Recommended Time (in seconds)*	*Useful Range (in seconds)*
Tri-Chem Pack	Makes 8 oz. ready to use.	60	45 to 120
Universal M-Q	Makes 8 oz. ready to use.	60	45 to 120
Versatol	1:3	60	45 to 120
Dektol or D-72	1:2	60	45 to 120

Acid Stop Bath: Rinse 5 to 10 seconds, with agitation, in Kodak Indicator Stop Bath or Kodak Stop Bath SB-1 at 65 to 70 F (18 to 21 C).

Fixing: Use Kodak Acid Fixer, Kodak Rapid Fixer, or Kodak Fixing Bath F-5 or F-6 at 65 to 70 F (18 to 21 C). For the two-bath method, fix 3 to 5 minutes in each bath; for the single-bath, 5 to 10 minutes.

Kodak Hypo Clearing Agent Treatment: See page 45.

Washing: After fixing, transfer the prints with or without rinsing, to a solution of Kodak Hypo Clearing Agent. Treat single-weight prints at least 2 minutes and double-weight prints at least 3 minutes with agitation at 65 to 70 F (18 to 21 C). Then wash single-weight prints at least 10 minutes and double-weight prints at least 20 minutes with agitation and normal water flow.

Prints not treated in Kodak Hypo Clearing Agent Solution should be washed for at least one hour in running water at 65 to 70 F (18 to 21 C).

Drying: All surface water should be removed with a viscose sponge to minimize drying cockle. Prints can then be dried in a Kodak Photo Blotter Roll, between clean, white, photographic blotters, or face down on clean cheesecloth stretchers or a laundered sheet. For extra-high gloss, prints can be ferrotyped.

Data—KODAK VELOX PAPER

Purposes: Velox is the ideal contact printing paper for making album prints. This paper has a uniform tone throughout all grades. Six grades make it ideal for making prints from a variety of negatives of different density scales.

Tone: Blue-black, uniform through all grades.

Grade, Speed, and Scale Index Value:

Grade	*Shadow Speed*	*Printing Index*	*Approximate Scale Index*	*Negative Density Scale*
1	32	100	1.5	High
2	20	50	1.3	Normal
3	16	32	1.1	Low
4	10	20	0.9	Very Low

Tint, Brilliance, Surface, and Weight: F (White, glossy, smooth), Single Weight.

Safelight Recommendation: Kodak Safelight Filter, Wratten Series OA.

Development Recommendations: (at 68 F or 20 C)

Kodak Developer	*Dilution*	*Recommended Time (in seconds)*	*Useful Range (in seconds)*
Dektol or D-72	1:2	60	45 to 120

Acid Stop Bath: Rinse 5 to 10 seconds, with agitation, in Kodak Indicator Stop Bath or Kodak Stop Bath SB-1 at 65 to 70 F (18 to 21 C).

Fixing: Use Kodak Acid Fixer, Kodak Rapid Fixer, or Kodak Fixing Bath F-5 or F-6 at 65 to 70 F (18 to 21 C). For the two-bath method, fix 3 to 5 minutes in each bath; for the single-bath, 5 to 10 minutes.

Kodak Hypo Clearing Agent Treatment: See page 45.

Washing: After fixing, transfer the prints with or without rinsing, to a solution of Kodak Hypo Clearing Agent. Treat single-weight prints at least 2 minutes and double-weight prints at least 3 minutes with agitation at 65 to 70 F (18 to 21 C). Then wash single-weight prints at least 10 minutes and double-weight prints at least 20 minutes with agitation and normal water flow.

Prints not treated in Kodak Hypo Clearing Agent Solution should be washed for at least one hour in running water at 65 to 70 F (18 to 21 C).

Drying: All surface water should be removed with a viscose sponge to minimize drying cockle. Prints can be ferrotyped.

Exposure and Development Latitude: Velox Paper satisfactorily accommodates overexposure up to 1.5 times normal.

Data—KODAK AZO and ILLUSTRATORS' AZO PAPERS

Purposes: Azo is a contact printing paper maintaining a uniformly high quality over a range of six grades. For this reason, it is suitable for printing when negatives vary widely in contrast. Somewhat warmer in tone, Illustrators' Azo, a contact paper designed primarily for the illustrator and commercial photographer, is available in five grades.

Tones: Azo E and F yield a neutral-black image tone. Illustrators' Azo has a warm-black image tone.

Grade, Speed, and Scale Index Value:

Grade	*Shadow Speed*	*Printing Index*	*Approximate Scale Index*	*Negative Density Scale*
0	16	80	1.7	Extremely High
1	12	64	1.5	High
2	10	40	1.3	Normal
3	10	32	1.1	Low
4	8	20	0.9	Very Low
5*	6	12	0.7	Extremely Low

*Not available in Illustrators' Azo.

Tint, Brilliance, Surface, Weight, Symbol, and Grade: Kodak Azo

Tint	*Brilliance*	*Surface*	*Single Weight Symbol and Grades*	*Double Weight Symbol and Grades*	*Post Card Symbol and Grades*
White	Glossy	Smooth	F No. 0, 1, 2, 3, 4, 5	F No. 0, 1, 2, 3, 4	F No. 1, 2, 3, 4
White	Lustre	Fine Grained	E No. 0, 1, 2, 3, 4, 5	E No. 1, 2, 3, 4	E No. 1, 2, 3, 4
Snow-White	High Lustre	Fine Grained		D No. 1, 2, 3, 4	

Tint, Brilliance, Surface, Weight, Symbol, and Grade: Kodak Illustrators' Azo

Tint	*Brilliance*	*Surface*	*Single Weight Symbol and Grades*	*Double Weight Symbol and Grades*
White	Glossy	Smooth	F No. 0, 1, 2, 3, 4	F No. 1, 2, 3
White	Lustre	Fine Grained	E No. 1, 2, 3	E No. 1, 2, 3

Safelight Recommendation: Kodak Safelight Filter, Wratten Series OA.

Development Recommendations: (at 68 F or 20 C)

Kodak Developer	*Dilution*	*Recommended Time (in seconds)*	*Useful Range (in seconds)*	*Purpose*
Dektol or D-72	1:2	60	45 to 120	Cold Tones
Ektanol, Selectol or D-52	1:1	120	90 to 240	Warm Tones
Selectol-Soft	1:1	120	90 to 120	Lower Contrast

Acid Stop Bath: Rinse 5 to 10 seconds, with agitation, in Kodak Indicator Stop Bath or Kodak Stop Bath SB-1 at 65 to 70 F (18 to 21 C).

Fixing: Use Kodak Acid Fixer, Kodak Rapid Fixer, or Kodak Fixing Bath F-5 or F-6 at 65 to 70 F (18 to 21 C). For the two-bath method, fix 3 to 5 minutes in each bath; for the single-bath, 5 to 10 minutes.

Kodak Hypo Clearing Agent Treatment: See page 45.

Washing: After fixing, transfer the prints with or without rinsing, to a solution of Kodak Hypo Clearing Agent. Treat single-weight prints at least 2 minutes and double-weight prints at least 3 minutes with agitation at 65 to 70 F (18 to 21 C). Then wash single-weight prints at least 10 minutes and double-weight prints at least 20 minutes with agitation and normal water flow.

Prints not treated in Kodak Hypo Clearing Agent Solution should be washed for at least one hour in running water at 65 to 70 F (18 to 21 C).

Drying: Glossy prints can be ferrotyped. All surface water should be removed with a viscose sponge to minimize drying cockle. Then place prints on cheesecloth stretchers, between clean, white photo blotters, or on a belt drier.

Exposure and Development Latitude: Azo has some latitude on the underexposure side, making possible a degree of forced development when the printing exposure has been somewhat less than necessary.

Take any charmers like this? If he's intended for the pages of a magazine or newspaper, use glossy paper, such as Kodabromide F. For a print to be framed, try Medalist G, a fine-grained luster surface which also lends itself to toning.

Data—KODAK ATHENA PAPER

Purposes: Athena is a contact printing paper with qualities of brilliance and fine gradation which make it especially suitable for portraits.

Tone: Athena yields a brown-black image tone. Slightly warmer tones result from overexposure, and slightly colder tones from underexposure and overdevelopment.

Grade, Speed, and Scale Index Value:

Grade	*Shadow Speed*	*Printing Index*	*Approximate Scale Index*	*Negative Density Scale*
0	8	32	1.7	
1	6	25	1.5	High
2	5	16	1.3	Normal
3	4	8	1.1	Low

Safelight Recommendation: Kodak Safelight Filter, Wratten Series OA.

Tint, Brilliance, Surface, Symbol, and Grade: Double Weight

Tint	*Brilliance*	*Surface*	*Symbol and Grades*
Cream White	Lustre	Smooth	B No. 1
Cream White	Lustre	Fine-Grain	G No. 0, 1, 2, 3
Cream White	Lustre	Silk	Y No. 0, 1, 2, 3

Development Recommendations:

Kodak Developer	*Dilution*	*Recommended Time (in seconds)*	*Useful Range (in seconds)*	*Purpose*
Ektanol, Selectol* or D-52	1:1	120	90 to 240	Warm Tones
Selectol—Soft	1:1	120	90 to 240	Lower Contrast

Acid Stop Bath: Rinse 5 to 10 seconds, with agitation, in Kodak Indicator Stop Bath or Kodak Stop Bath SB-1 at 65 to 70 F (18 to 21 C).

Fixing: Use Kodak Acid Fixer, Kodak Rapid Fixer, or Kodak Fixing Bath F-5 or F-6 at 65 to 70 F (18 to 21 C). For the two-bath method, fix 3 to 5 minutes in each bath; for the single-bath, 5 to 10 minutes.

Kodak Hypo Clearing Agent Treatment: See page 45.

Washing: After fixing, transfer the prints with or without rinsing, to a solution of Kodak Hypo Clearing Agent. Treat single-weight prints at least 2 minutes and double-weight prints at least 3 minutes with agitation at 65 to 70 F (18 to 21 C). Then wash single-weight prints at least 10 minutes and double-weight prints at least 20 minutes with agitation and normal water flow.

Prints not treated in Kodak Hypo Clearing Agent Solution should be washed for at least one hour in running water at 65 to 70 F (18 to 21 C).

Drying: All surface water should be removed with a viscose sponge to minimize drying cockle. Prints can then be dried in the Kodak Photo Blotter Roll, between clean, white photographic blotters, or face down on clean cheesecloth stretchers or a laundered sheet.

Data—KODAK ARISTO PAPER

Purpose: Aristo is a contact printing paper of moderate warmth. It is particularly suited for portrait photographs.

Tone: Warm-black; somewhat warmer than Azo, but not as warm as Athena.

Grade, Speed, and Scale Index Value:

Grade	*Shadow Speed*	*Printing Index*	*Approximate Scale Index*	*Negative Density Scale*
0	16	80	1.7	
1	12	64	1.5	High
2	10	40	1.3	Normal
3	10	25	1.1	Low

Tint, Brilliance, Surface, and Symbol: Double Weight

Tint	*Brilliance*	*Surface*	*Symbol and Printing Grades*
Cream White	Lustre	Fine Grained	G No. 0, 1, 2, 3
Old Ivory	Lustre	Fine Grained	P No. 0, 2
Cream White	Lustre	Silk	Y No. 0, 1, 2, 3

Safelight Recommendation: Kodak Safelight Filter, Wratten Series OA.

Development Recommendations: (at 68 F or 20 C)

Kodak Developer	*Dilution*	*Recommended Time (in seconds)*	*Useful Range (in seconds)*	*Purpose*
Ektanol, Selectol* or D-52	1:1	120	90 to 240	Warm Tone
Selectol-Soft	1:1	120	90 to 240	Lower contrast

Acid Stop Bath: Rinse 5 to 10 seconds, with agitation, in Kodak Indicator Stop Bath or Kodak Stop Bath SB-1 at 65 to 70 F (18 to 21 C).

Fixing: Use Kodak Acid Fixer, Kodak Rapid Fixer, or Kodak Fixing Bath F-5 or F-6 at 65 to 70 F (18 to 21 C). For the two-bath method, fix 3 to 5 minutes in each bath; for the single-bath, 5 to 10 minutes.

Kodak Hypo Clearing Agent Treatment: See page 45.

Washing: After fixing, transfer the prints with or without rinsing, to a solution of Kodak Hypo Clearing Agent. Treat single-weight prints at least 2 minutes and double-weight prints at least 3 minutes with agitation at 65 to 70 F (18 to 21 C). Then wash single-weight prints at least 10 minutes and double-weight prints at least 20 minutes with agitation and normal water flow.

Prints not treated in Kodak Hypo Clearing Agent Solution should be washed for at least one hour in running water at 65 to 70 F (18 to 21 C).

Drying: All surface water should be removed with a viscose sponge to minimize drying cockle. Then place prints on cheesecloth stretchers, between clean, white photo blotters, or on a belt drier.

Data—KODAK RESISTO and KODAK RESISTO RAPID PAPERS

Purposes: Resisto and Resisto Rapid have a water resistant base. Prints can be processed completely in seven to eight minutes and dried in less than ten minutes if hung freely in the air. Dimensional changes are small, and Resisto Papers are valuable for map making, color-separation positives, or where rapid finishing is vital.

In photographic characteristics, Kodak Resisto N, for contact printing, is similar to Velox Paper; Kodak Resisto Rapid N, for enlarging, is similar to Kodabromide Paper. Both Resisto Papers yield a neutral-black image tone.

Surface and Weight: Both Resisto Papers are supplied in the N surface (white, lustre, smooth) and on single-weight stock.

Grade, Speed and Scale Index Value: Kodak Resisto

Grade	*Shadow Speed*	*Printing Index*	*Approximate Scale Index*	*Negative Density Scale*
0	50	200	1.7	Extremely High
2	20	50	1.3	Normal
3	16	32	1.1	Low
5	8	12	0.7	Extremely Low

Grade, Speed, and Scale Index Value: Kodak Resisto Rapid

Grade	*Shadow Speed*	*Printing Index*	*Approximate Scale Index*	*Negative Density Scale*
1	1600	5000	1.5	High
2	1250	3200	1.3	Normal
3	1000	2000	1.1	Low
4	650	1000	0.9	Very Low

Safelight Recommendations: For both Resisto and Resisto Rapid, the Kodak Safelight Filter, Wratten Series OA.

Development Recommendations: (at 68 F or 20 C)

Kodak Developer	*Dilution*	*Recommended Time (in seconds)*	*Useful Range* *
Dektol or D-72	1:2	60	*

Acid Stop Bath: Rinse for about 5 seconds in Kodak Indicator Stop Bath or Kodak Stop Bath SB-1 with thorough agitation at 65 to 70 F (18 to 21 C).

Fixing: 2 minutes with continuous agitation in a fresh solution of Kodak Acid Fixer or in Kodak Fixing Bath F-5 or F-6.

Washing: 4 minutes at 65 to 75 F (18 to 24 C). Use running water and agitate.

Drying: For fast drying, remove water with blotters or soft sponge or cloth. Then keep print in motion over moderate heat. Heated belt-type dryers are not recommended. To keep dimensional changes low, do not use heat. Do not ferrotype.

Mounting: Kodak Rapid Mounting Cement is the only adhesive recommended for mounting Resisto Papers. Ordinary mounting adhesives such as Kodak Dry Mounting Tissue will not adhere to the water-resistant base.

*Any processing step prolonged beyond recommended times will allow the base to absorb moisture, and drying will not be so rapid.

Data—KODAK POLYCONTRAST PAPER

Purposes: This is a variable-contrast paper suitable for making high-quality enlargements. With reduced illumination, it can be used for contact printing. It is especially useful in the commercial, industrial, photofinishing, and school photographic fields.

Tone: Warm-black, somewhat warmer than Polycontrast Rapid.

Filter, Speed, and Scale Index Value:

Kodak Polycontrast Paper is available in one grade only, but its printing contrast can be varied over a wide range by exposure through suitable filters, such as those supplied in the Kodak Polycontrast Rapid Filter Kit (Model A).

*Filter**	*Shadow Speed*	*Printing Index*	*Approx. Scale Index*	*Corresponding Grade of Kodak Medalist Paper*
1	200	1000	1.5	1
1½	320	1000	1.4	
2	320	1000	1.3	2
2½	320	1000	1.2	
3	320	800	1.1	3
3½	250	640	1.0	
4	160	400	0.90	4

*White-light exposure (exposure with no filter) would have shadow speed of 400, printing index of 1250, and approximate scale index of 1.4.

Tint, Brilliance, Surface, Weight, Symbol, and Grade:

Tint	*Brilliance*	*Surface*	*Single Weight Symbol*	*Double Weight Symbol*
White	Glossy	Smooth	F, N	F, N
White	Lustre	Smooth	F, N	F, N
Cream-white	Lustre	Fine-grained		G

Safelight Recommendation: Kodak Safelight Filter, Wratten Series OC (light amber), used in a suitable safelight lamp *with a 15-watt bulb, kept at least 4 feet from the paper.* A Series OA Safelight Filter must *not* be used.

Development Recommendations: (at 68 F or 20 C)

Kodak Developer	*Dilution*	*Development Time in Minutes*		*Purpose*
		Recommended	*Useful Range*	
Dektol or D-72	1:2	1½	1 to 3	Normal tones
Dektol or D-72	1:2	2	—	For toning in Kodak Brown Toner or Polysulfide Toner T-8

Acid Stop Bath: Rinse 5 to 10 seconds, with agitation, in Kodak Indicator Stop Bath or fresh Kodak Stop Bath SB-1 at 65 to 70 F (18 to 21 C).

Fixing: Use Kodak Acid Fixer, Kodafix Solution, Kodak Rapid Fixer, or Kodak Fixing Bath F-5 or F-6 at 65 to 70 F (18 to 21 C). For two-bath method, fix

3 to 5 minutes in each; for single bath, 5 to 10 minutes.

Washing: After fixing, transfer the prints with or without rinsing, to a solution of Kodak Hypo Clearing Agent. Treat single weight prints at least 2 minutes and double weight prints at least 3 minutes with agitation at 65 to 70 F (18 to 21 C). Then wash single-weight prints at least 10 minutes and double-weight prints at least 20 minutes with agitation and normal water flow.

Prints not treated in Kodak Hypo Clearing Agent Solution should be washed for at least one hour in running water at 65 to 70 F (18 to 21 C).

Drying: All surface water should be removed with a viscose sponge to minimize drying cockle. Then place print on cheesecloth stretchers, between clean white photo blotters, or on a belt dryer.

Data—KODAK POLYCONTRAST RAPID PAPER

Purposes: This is a variable-contrast, projection-speed paper suitable for making high-quality enlargements. It is especially useful in the commercial, industrial, photofinishing, and school photographic fields.

Tone: Warm-black.

Filter, Speed, and Scale Index Value:

*Filter**	*Shadow Speed*	*Printing Index*	*Approx. Scale Index*	*Corresponding Grade of Kodak Medalist Paper*
1	500	2000	1.5	1
1½	800	2500	1.4	
2	800	2000	1.3	2
2½	800	2000	1.2	
3	640	1600	1.1	3
3½	500	1000	1.0	
4	320	640	0.90	4

*White-light exposure (exposure with no filter) would have shadow speed of 1000, printing index of 3200, and approximate scale index of 1.4.

Tint, Brilliance, Surface, Weight, Symbol, and Grade:

Tint	*Brilliance*	*Surface*	*Single Weight Symbol*	*Double Weight Symbol*
White	Glossy	Smooth	F	F
White	Lustre	Smooth	N	
Cream-white	Lustre	Fine-grained		G
Cream-white	Lustre	Silk		Y

Safelight Recommendation: Kodak Safelight Filter, Wratten Series OC (light amber), used in a suitable safelight lamp *with a 15-watt bulb, kept at least 4 feet from the paper.* Safelight exposures under these conditions should not exceed 3 minutes. A Series OA Safelight Filter must *not* be used.

Development Recommendations: (at 68 F or 20 C)

Kodak Developer	*Dilution*	*Development Time in Minutes*		*Purpose*
		Recommended	*Useful Range*	
Dektol or D-72	1:2	1½	1 to 3	Normal tones
Dektol or D-72	1:2	2	—	For toning in Kodak Brown Toner or Polysulfide Toner T-8.

Acid Stop Bath: Rinse 5 to 10 seconds, with agitation, in Kodak Indicator Stop Bath or fresh Kodak Stop Bath SB-1 at 65 to 70 F (18 to 21 C).

Fixing: Use Kodak Acid Fixer, Kodafix Solution, Kodak Rapid Fixer, or Kodak Fixing Bath F-5 or F-6 at 65 to 70 F (18 to 21 C). For two-bath method, fix 3 to 5 minutes in each; for single bath, 5 to 10 minutes.

Washing: After fixing, transfer the prints with or without rinsing, to a solution of

Kodak Hypo Clearing Agent. Treat single weight prints at least 2 minutes and double weight prints at least 3 minutes with agitation at 65 to 70 F (18 to 21 C). Then wash single-weight prints at least 10 minutes and double-weight prints at least 20 minutes with agitation and normal water flow.

Prints not treated in Kodak Hypo Clearing Agent Solution should be washed for at least one hour in running water at 65 to 70 F (18 to 21 C).

Drying: All surface water should be removed with a viscose sponge to minimize drying cockle. Then place print on cheesecloth stretchers, between clean white photo blotters, or on a belt dryer.

Data—KODAK TONERS FOR KODAK PHOTOGRAPHIC PAPERS

It should be kept in mind that, aside from the actual toner used, the final hue of a toned print is influenced by emulsion type, age, and storage conditions of the paper, processing variations prior to toning, and variations in toning procedure. Successful toning is particularly dependent on careful print processing such as full development, use of a fresh fixing bath, Kodak Hypo Clearing Agent, and adequate washing prior to toning. For more complete information on toning, consult the Kodak Data Book, "Professional Printing with Kodak Photographic Papers" which contains a toning chart showing a range of tones available with various paper-toner combinations.

Kodak Paper	*Hypo Alum Sepia T-1a*	*Sepia or Sulfide Sepia T-7a*	*Brown or Poly-sulfide T-8*	*Gold T-21*	*Rapid Selenium*	*Combi-nation Brown and Selenium*	*Blue*
Ad-Type	X	X	P	NR	X	P	NR
Aristo	X	X	X	P	P	P	X
Athena	X	X	X	P	P	P	X
Azo	X	X	P	NR	X	P	NR
Ektalure	X	X	X	P	P	P	P
Illustrators' Azo	X	X	X	P	P	P	X
Illustrators' Special	X	X	X	P	P	P	X
Kodabromide	X	P	NR	NR	NR	NR	NR
Medalist	P	P	P	NR	X	P	P
Mural	P	P	P	NR	X	P	P
Opal	X	X	X	P	P	P	P
Portrait Proof	X	X	X	P	P	P	X
Polycontrast and Polycontrast Rapid	X	P	P	NR	NR	NR	P
Velox	P	P	X	NR	NR	NR	X
Velox Rapid	P	P	X	NR	NR	NR	X
Velox Unicontrast, Rapid	P	P	X	NR	X	NR	X

P —Primary recommendation
X —Although not a primary recommendation, a tone can be secured.
NR—Not recommended

authoritative reference books

Kodak Reference Handbook (Two Volumes). A comprehensive two-volume set, each volume containing four complete Kodak Data Books. Discusses materials, flash, enlarging, and processing techniques.

Kodak Color Handbook. A complete guide to taking still pictures in color. Four Kodak Color Data Books in a Mult-O Ring binder cover theory, data, and use of color materials.

Kodak Photographic Notebook. A flexible Mult-O Ring binder containing five separators and a supply of blank paper. Ideal for filing notes and booklets to supplement the Kodak Handbooks.

Kodak Master Photoguide. A pocket library of photo data with many computing aids. Contains exposure data for most types of situations encountered in the studio, at home, or in the field.

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